GAS JOURNAL

LIGHT ∴ HEAT ∴ POWER

BYE-PRODUCTS.

Founded in 1849 as the "Journal of Gas Lighting."

VOL. CLXXXIV.

OCTOBER TO DECEMBER, 1928.

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WALTER KING, LTD.,

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1928.

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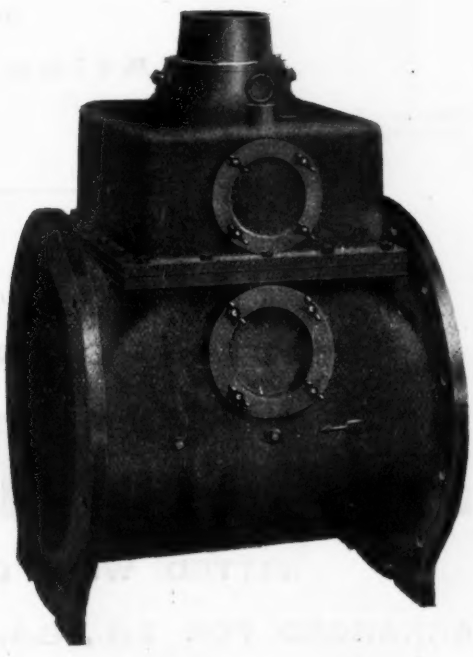

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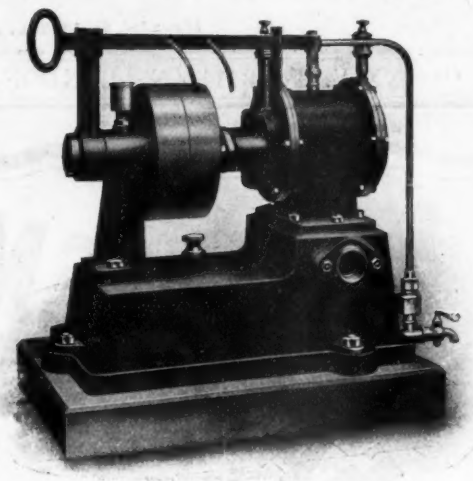

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VOL. CLXXXIV. No. 3411.] WEDNESDAY, OCTOBER 3, 1928. [80TH YEAR.

Editorial Notes.

The Penalty of Efficiency.

IT is the willing horse that bears the heaviest burden; and the gas industry has invariably been so quiet and so patient that it affords an excellent example of the truth of this saying. It has felt secure in the righteousness of its clause, and has perhaps not fully realized that even in the best of circumstances Justice must be sought, and sought diligently, if she is to be found. The gas industry feels that it is entitled to greater freedom; and nothing has been seriously urged against the granting of it. Most reasonable demands for the removal of restrictions have been put forward by the National Gas Council; but the Government, as Mr. Henry Woodall, M.Inst.C.E., remarked at the recent meeting of the British Gas Light Company, Ltd., appears to have no inclination and no time to deal with them.

Mr. Woodall rightly argued that the fact that the less fortunate industries have to be dealt with affords no reason why the efficient should not be allowed to increase their usefulness. Were it not for the painful evidence we have had to the contrary, it would seem hardly necessary to point this out. It must be obvious to any who think at all about the matter that efficiency is deserving of encouragement, and not discouragement. What, then, is the cause of this extraordinary neglect of the requests of an industry which has at its back more than a century of good and unfailing service—an industry that has given to the community in this service immeasurably more than it has received back by way of dividend? An answer was provided at the meeting by Mr. G. Hay Morgan, K.C.; and a very reasonable answer it appeared to be. The explanation of this neglect of a vital industry, he said, is that that industry has been somewhat too quiescent in the past—it has not made itself sufficiently audible in dealing with the Government.

These are not our words; they are the words of Mr. Hay Morgan, who declared that a government never gives freedom because it is just, but only when it must. Therefore, he said, the necessary pressure must be brought to bear by the people who desire that freedom. The gas industry should cry out a great deal louder than it has done; and then, Mr. Hay Morgan has no doubt, the Government will respond to the appeal. This advice seems sound. If Justice must be sought, let us seek her energetically, resolved not to abandon the search until she has been secured. The total number of those who have invested money in the industry and those who are engaged in it must be many hundreds of thousands; and if all join earnestly in the search, justice will be found at last, and a great national industry will have received the due reward of its efficiency and its invaluable public service.

Valuation and Taxation of Gas Undertakings.

THE Rating and Valuation Act, 1925, and the revaluation occasioned thereby, have made the subject of the assessment of gas undertakings to local rates one of pressing interest to all the English undertakings. In Scotland, although not for the same reason, a similar interest is being shown, as is evidenced by the discussion which took place at the September meeting of the North British Association of Gas Managers on the paper read by Mr. Simpson in April. To this discussion the letter from Mr. Napier in last week's issue forms a most useful and interesting addendum, and should re-assure those members who were inclined to think that the National Gas Council was not fully alive to the importance of this question as it affects the Scottish undertakings. The discussion ranged round many aspects of the question, both of principle and of method; but perhaps it is not unreasonable to suppose the main concern of those responsible for the administration of gas undertakings to be the amount of the rates that are, or may become, payable, and the consequent effect upon the price of gas. An alteration of the basis, or a change in the method of assessment, would hardly commend itself to the practical mind unless it tended to a lessening of, or at least avoided any increase in, the present burden.

The existing basis of assessment of all kinds of property is, we believe, uniquely the rent which a tenant does or would pay, albeit that in some cases special allowances are made, such as those under the de-rating Act passed last session. The President suggested that gas undertakings might be assessed at an amount per 1000 c.ft., or per therm. This would certainly be a simplification; but it is another matter whether it would act fairly as between (say) two undertakings not in the same financial circumstances and selling gas at widely different prices. Also, would it be equitable as between us and our competitors? If it had the result of putting us at a disadvantage, we should object; and if them, they would hardly be likely silently to acquiesce in the change. And if gas undertakings at per therm, ought not electricity undertakings to be assessed at so much per unit, water at per 1000 gallons, railways at per ton-miles, even public houses at per unit of alcohol, and so on? Simplification! Well, perhaps in one sense as between undertakings in the same industry. But the general adjustment of the burden equitably as between different ratepayers in the same area might become more difficult if there were a multiplicity of bases instead of the simple one of rent at present applicable to all ratepayers, and which can be applied to all hereditaments. If assessment on the present basis results in a burden which on public grounds is too heavy on cer-

tain ratepayers, then the relief already given to particular industries should be extended. For such relief the gas industry has a strong claim.

But although a change of basis is, we think, scarcely practicable, or perhaps even desirable, that does not mean that the matter should be left where it is. It is thoroughly bad from the point of view of public interest that serious uncertainty should exist as to the fairness of an assessment. When the landlord and tenant are one, and the rent has to be estimated, differences of opinion are bound to arise; but if these differences could be reduced to reasonable proportions, most of the difficulties in settling a fair assessment would be removed. Though not confined to the tenant's share, the main difficulties centre on this: What remuneration would a tenant require for carrying on the undertaking? In the light of the legal decisions given, there ought not to be much room for dispute as to the items to be included in the tenant's capital—or indeed, as a rule, upon the value to be put upon them. It should therefore be possible for some agreement to be reached with the authorities on these points, at any rate in principle; and we suggest this as a promising line of advance. "In principle" is said advisedly, as, having regard to past experience, it would probably be unwise to agree an exact list of the items. For instance, had such a list been in existence before the introduction of the prepayment system, it might have prevented the inclusion in the tenant's capital of the pipes and fittings. Then there is the question of the tenant's share calculated as a percentage of the tenant's capital. No doubt undertakings vary, and what would be reasonable for a stable and prosperous concern would be totally insufficient for a poor and struggling undertaking. Yet wide differences between estimates in normal cases could surely be avoided, and a measure of agreement reached.

Scotland has difficulties of its own—as, for instance, in the practice that seems to be usual of increasing the rent by allowing a smaller percentage on tenant's capital in the case of an undertaking owned by a local authority than where the owner is a company. This would appear to be simply an injustice which ought to be redressed without delay.

Keep a Stout Heart.

In recent numbers of the "Journal," a good deal of space has been devoted to the question of the lighting load. It is felt that there has been too great readiness in some quarters to surrender this important part of the gas industry's business—important not perhaps so much from the point of view of the amount of gas involved, though that is considerable, but certainly on account of its moral effect. No doubt, some lighting must be lost, but that is no reason for parting with anything that can be retained, and with sufficient determination much of it can be kept in the hands of the gas industry. The will to retain the lighting load must carry with it service of the best; nothing less will do.

Every day, increasing attention is being paid to illumination—in factories, in streets, and in homes. Employers understand better now than was the case in times gone by how great is the effect on production of adequate or inadequate illumination; and even if they did not realize the importance of good lighting from this point of view, it would be forced upon them by the additional risk of injury arising from the continually increasing use of complicated machinery. Here gas meets nearly every need. Greater traffic speeds and the growing number of mechanically propelled vehicles upon the roads call also for adequate illumination; and gas will provide it. No one who has seen Whitehall can doubt this. There will be many more cars upon the roads next year; and still better lighting than now will be called for in various parts of the country. Again, gas can furnish it. In the home, also, gas can fill most wants, providing maintenance is efficient and the composition of the gas is kept constant; but no amount of burner adjustment can satisfy the consumer if heed is not paid to the second requirement. However much constant change may have to recommend it with regard to some things, there is little to be found in its favour when applied to the composition of gas.

There is no need to let the lighting load go; but its retention must involve greater consideration being paid to it than was called for years ago. Therefore let the industry keep up a stout heart, and face the situation squarely. Those who do so will derive encouragement from a statement made by the Chairman and Managing Director (Mr. Henry Woodall, M.Inst.C.E.) at last week's meeting of the British Gas Light Company, Ltd. While admitting that it would be folly to suggest that electrical competition is negligible, he went on to state that quite recently, at a meeting of an important Gas Company of which he is Chairman, it was reported that two factories had adopted gas lighting in face of strong electrical competition. One of the factories had installed 207 high-pressure gas lamps of 750 c.p. each, and the other an even larger number. There can be no reason why what has been done in the case of these two factories should not be accomplished elsewhere.

Ricoal.

At least ten years have elapsed since serious work was started on the Illingworth process of low-temperature carbonization; and now, it appears, this period of intensive experimental investigation has been crowned with a considerable measure of success, both technical and commercial. At all events, a large installation on this system, for carbonizing Kent coal, is being erected at the Snowdown Colliery of Messrs. Pearson & Dorman Long, Ltd. Throughout this period of development, the Illingworth Carbonization Company, Ltd., have conducted their operations without fuss; and they have not resorted to unscientific publicity. For these reasons alone, the paper on "Low-Temperature Carbonization" which Mr. David Muir, the Engineer and Manager of the Pontypridd Gas-Works, presented at the meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers last Thursday is most acceptable. Apart from these considerations, however, Mr. Muir's account of the working of a 50-ton per day Illingworth plant is particularly interesting in that it shows how suitably placed a gas undertaking is to exploit to the best advantage any system of low-temperature carbonization which may prove itself to be a commercial proposition. In the earliest days of gas manufacture, coal was carbonized at low temperatures; and the public make a huge mistake if they imagine that the gas industry regards low-temperature carbonizing with disfavour simply because low temperatures are employed, or that the industry is guilty of inattention to a subject which—thanks largely to publicity not in any way disinterested—is proving so attractive to the lay mind, yet so doubtful a blessing to the lay pocket.

The low-temperature plant at the Pontypridd Gas-Works has been in operation since the winter of 1924; working being continuous except for the period of the coal strike in 1926. Consequently there has been ample opportunity of discovering and remedying faults in the process, and of reaching a decision regarding its commercial possibilities. As a gas-making plant the Illingworth unit has no unusual attraction. An output of 5300 c.ft. of 680 B.Th.U. gas (36 therms) per ton of coal carbonized will fail to allure even the most tender-hearted gas engineer who appreciates the relative values of gaseous and solid therms, and who feels that low-temperature carbonization is not the only method of producing a smokeless solid fuel which will satisfy the public's legitimate demands. The plant is obviously efficient in respect of heat transmission from the flues to the charge, and the throughput of coal is therefore flexible; but from the gas-maker's point of view the commercial efficiency of a gas plant on a given site area, though governed more by throughput capacity than by "therms per ton" yield, demands that the yield of gas per ton should be high. Hence it seems that a gas undertaking would have little justification in erecting a low-temperature unit such as the Illingworth unless it be as a minor adjunct to the main gas-making plant.

With regard to the Illingworth plant as a means of producing, not gas, but smokeless solid fuel, the chief impression on reading Mr. Muir's paper is gained from his remarks on "Ricoal." The low-temperature plant at the Pontypridd Gas-Works is situated in a coalfield where there are ample supplies of gas-works coke, coke-oven

coke, and gas; and yet the "Ricoal" is welcomed, and enjoys a ready market at £1 per ton. This shows that "Ricoal" is satisfactory in its performance and in its price; and without this happy combination, no smokeless fuel will attain success in the domestic market. The fact that this point is not fully appreciated generally by many low-temperature enthusiasts, dooms many systems to great hardship, if not to failure.

The Illingworth Carbonization Company are able to sell their "Ricoal" at £1 per ton, even when it is manufactured in a small plant, by buying washed slack at 10s. per ton, selling their tar at 4d. a gallon and their benzole at 1s. a gallon, and selling their surplus gas—which amounts to 2500 c.ft. (17 therms) per ton of coal treated—at 5d. per 1000 c.ft. to the Pontypridd Council. In two respects, then, the plant at Pontypridd is happily situated—first in being able to purchase coal containing only 4·6 p.ct. of ash at such a low price, and secondly in finding a lucrative outlet for the surplus gas. The first of these factors is, of course, the one of chief import; and it is but natural to inquire how long washed smalls of such low ash content will remain so inexpensive if the demand for them increases rapidly. Mr. Muir's admirable account of the Illingworth process certainly indicates that a low-temperature system aiming at the capture of the domestic solid fuel market is well advised to be in close proximity to the mines.

"L-T" Town Gas and Electricity.

WE publish to-day an illustrated article describing the progress which is being made in a remarkable New Jersey venture destined to supply daily over three million c.ft. of low-temperature gas to the New Brunswick Public Service Electric and Gas Company. The plant for this purpose is the "K.S.G."—a description of which system appeared in the "JOURNAL" for Aug. 22—and it is being installed and operated by the International Combustion Engineering Corporation of New York. The capacity of the setting will be 640 tons of coal per day on normal running; and the gas produced, which will have a calorific value of 800 B.Th.U. per c.ft., will be diluted with producer gas or blue water gas, to bring down the calorific value to about 530 B.Th.U. per c.ft. It will then be piped to the New Brunswick Company. An important feature of this enterprise is that full provision has been made for possible failure of the low-temperature gas supply. Those responsible guarantee a daily minimum quantity of gas; and to cope with any emergency, they have erected on the site of the low-temperature plant carburetted water gas units capable of generating the guaranteed amount of gas when working on raw coal. Without knowledge of the price at which it is intended to supply this low-temperature gas, and of the cost of coal and the purchase price of the solid and liquid products, further comment is of no value; but we look forward with interest to the results of the scheme after it has been in full operation for some time.

The idea that electricity suppliers should subject their coal to low-temperature distillation, and employ for generating electricity the solid residue, after abstraction of valuable bye-products, is by no means new; but few electricity undertakings have as yet considered themselves justified in increasing their capital and complicating their process for what may turn out to be a complete failure. The chief difficulty, of course, has been a nice interpretation of the adjective "valuable" as applied to these bye-products. At the Dunston Power Station of that notably efficient concern the Newcastle-upon-Tyne Electric Supply Company, however, a low-temperature plant possessing extraordinary flexibility is operating in conjunction with the electricity generating plant. The highly satisfactory working of the two units was described at the World Power Fuel Conference on Friday last by Mr. R. P. Sloan, C.B.E., whose paper "The Economic Utilization of Fuel in the Production of Electricity" received such amazing misinterpretation at the hands of the Daily Press prior to the conference—gross exaggeration and sensationalism which Mr. Sloan firmly denounced last Friday. At the Dunston Station, coal is purchased at 12s. a ton. Subjected to low-temperature distillation, it yields liquid products of a value of 10s. 6d.; and the semi-coke and gas, valued at 9s. 1d., are burned under the boilers. The operation of the plant, which is capable of treating about 100 tons of coal per day, costs 4s. 8d. per ton of coal carbonized; and therefore there is a definite advantage. Mr. Sloan stated that in present circumstances and at present prices no important commercial economies have so far been obtained; "but conditions may change, and consequently the careful study and extensive experiments that are being made in this direction may be of the greatest use in the future." While reiterating an observation made previously—that increased demand for lower-grade coals can only have one effect on their price—we feel that the gas industry is well advised to take stock of the enterprise which is being shown in other spheres.

A Clear Horizon.

LAST week's proceedings at the World Power Conference on Fuel are likely to have a wide co-ordinating influence upon the carbonizing industries of this country; and the airing of opinions which has taken place will make far easier the co-operation which is so vitally essential at the present juncture. The gas industry and the coke oven industry can regard with satisfaction the fact that before the publication of the National Fuel and Power Committee's report they had realized that there was room for the mechanism of co-operation, and had established a Joint Committee for the discussion of problems and to act in an advisory capacity; for that report, of which we published an extended extract last week, makes co-operation the duty of all concerned. It was, therefore, particularly appropriate that at the close of the session of the Fuel Conference over which he presided, Sir David Milne-Watson should have risen to deny the existence of animosity between the industries, at which at least one speaker had hinted. Differences of opinion are bound to exist, and it is the co-operation for which we plead that will bring diversities into alignment and smooth over difficulties. Nothing is to be gained by coercion, and it was unfortunate that one section of the coke oven industry should have urged upon the National Fuel and Power Committee their view that so long as surplus coke oven gas was available, neighbouring gas undertakings should be denied powers to extend their gas-manufacturing capacity.

In later columns to-day we publish a report of the Section G discussion on the carbonization industry. Practically every speaker whose remarks we reproduce added something of value towards comprehension of the situation as it exists between the gas and the coke oven industries; and we find nothing to alter our belief that units of those industries will to an increasing extent come to working agreements—as they have done in the past. Meanwhile, we look forward eagerly to the Government investigation of the possibilities of "area gas supply."

Co-Operation in Industry.

In an interview with the "Financial Times," Lord Melchett has confessed to a considerable sense of gratification at the success achieved so far by the efforts to bring employers and employees closer together. These efforts are all to the good; and if, as Lord Melchett believes will be the case, they should lead to a number of practical steps, each of them directed to the more equitable division of the results of industry, then indeed will a task of vital importance have been accomplished. Of course, this more equitable division of the results of industry must, in the main, refer to profits; for the difficulty about sharing in results of every kind is that the workers are really hardly in a position, as things stand now, to bear a proportion of losses when they occur. This refers to businesses experiencing fluctuations while continuing to carry on. Should a business fail completely, the workers' livelihood is gone; he has contributed his all to the disaster. The terrible examples of hardship that one comes across to-day in the South Wales coalfields reveal the nature of the stake which, in the last resort, the worker has in his industry. This, however, is a different thing altogether. Broadly, Capital and Labour must sink or swim together; but while swimming, Labour is not so well able as is Capital to shoulder a proportion of the liabilities resulting from temporary reverses. However, as Lord Melchett says, we have come to realize that the first consideration of all engaged in industry is to make it

profitable, so that there may be adequate rewards all round. This can be brought about only by co-operation; it can never be attained by disputes involving enormous cost, which has to be met in one way or another by the industry concerned. Pulling down is not a successful method of building up.

Standardized Page Size.

Standardization, while enormously facilitating mass production, and offering great conveniences in other directions, is never likely to be welcomed in some connections. One does not like standardized food; and standardized clothing can be carried too far—or not far enough! Would a standardized size of page for technical journals be hailed with joy? As it is, such publications are not invariably received with open arms; would they be greeted with any greater cordiality if their resemblance to each other was more marked? We do not think so; and for our own part, we feel a strong partiality to our individuality. Nevertheless, there is a good deal, from the advertisers' point of view, in a suggestion put forward by Mr. W. McWilliam, in a letter to the "Electrician," to the effect that technical journals representing similar interests could benefit themselves very largely by standardizing their page sizes. He says that the recent research conducted by the Incorporated Society of British Advertisers on the net printed size of various technical journals has revealed a bewildering variety of spaces and proportions among them.

BRITISH COMMERCIAL GAS ASSOCIATION.

General Meeting and Conference at York.

The following is the programme arranged for the Seventeenth Annual General Meeting and Conference of the British Commercial Gas Association, to be held at York on Monday, Tuesday, and Wednesday, Oct. 22, 23, and 24, under the Presidency of Mr. Alfred Procter, Chairman of the York Gas Company.

Monday, Oct. 22.

Reception and Lecture in the Assembly Rooms.

8. 0 p.m. Reception by Mr. Alfred Procter (President of the "B.C.G.A.,' and Chairman of the York Gas Company) and Mrs. Procter.

8.30 p.m. Lecture by Sir William Arbuthnot Lane, Bart., M.B.,' M.S.Lond., F.R.C.S. (a Founder and President of the New Health Society), on "The Gas Industry in Relation to the Health of the People."

9.15 to 10.30 p.m. Light refreshments. Music.

Tuesday, Oct. 23.

Public Conference in the Assembly Rooms.

10.30 a.m. Assembly of members.

10.45 a.m. Welcome by the Rt. Hon. the Lord Mayor of York (Alderman Arthur R. Fox).
Presidential Address of Mr. Alfred Procter.
Address by Sir Lawrence Weaver, K.B.E., on "Art in Industry."

12.45 p.m. Adjournment for luncheon.

2. 0 p.m. Assembly at the Assembly Rooms. Informal visits to places of interest in York. Guides will be available.

4.15 p.m. At the Merchant Adventurers' Hall. Afternoon tea by invitation of the Chairman and Directors of the York Gas Company, followed by a talk by Mr. Ernest Hunt on "Business—Ancient and Modern."

5. 0 p.m. Adjournment.

In the Assembly Rooms.

7.15 for 7.30 p.m. Dinner by invitation of the Chairman and Directors of the York Gas Company to the President-Elect, Vice-Presidents, and members of the "B.C.G.A." and visitors.
Reception of guests by the President, 7.15 p.m. Evening dress. Decorations will be worn.

Wednesday, Oct. 24.

Private Conference in the Assembly Rooms.

9.30 a.m. Assembly of members.

9.45 a.m. Opening remarks by the President of the Conference.
Paper by Mr. Harold E. Bloor, B.Sc., B.Eng. (Engineer, Secretary, and Manager of the York Gas Company), on "Local Publicity—With Special Reference to Showrooms."
Discussion.
Presentation of Annual Report and Statement of Accounts by the Executive Chairman, Mr. F. W. Goodenough, C.B.E.
Motion to approve and adopt the recommendation of the General Committee for the Amendment of the Constitution and Rules of the Association to be circulated with the Seventeenth Annual Report.
Joint Conference of members of the National Gas Council and the British Commercial Gas Association on "Methods of Charge."

12.50 p.m. Adjournment.

1. 0 p.m. Luncheon in the Guildhall by invitation of the President-Elect, the Vice-Presidents, and members of the Association, to the President and the Directors of the York Gas Company.

2.30 p.m. Resumption of joint conference.

PERSONAL.

A presentation of a pair of binoculars, a pewter coffee pot, and a fruit dish, from the Engineer and Staff of the City of Leicester Gas Department, was made by Mr. Hubert Pooley, M.Inst.C.E., on Sept. 26, to Mr. Edgar Field, who has been Chief Accountant for the last 7½ years, on his retirement after 53 years in the service of the undertaking.

An interesting ceremony took place in the Board Room of the Horley District Gas Company on Sept. 26, when Mr. Burt Long, the Secretary of the Company, was, on the occasion of his marriage, presented by the office staff with a silver cake basket and toast-rack. The presentation was made by the oldest member, who expressed the staff's best wishes for Mr. Long's future health and prosperity. In acknowledging the gifts, Mr. Long said that he had always been proud of the good feeling which prevailed throughout the secretarial department.

In place of the late Mr. William J. Moon, Mr. J. Granger has been elected Managing Director of the Torpoint Gas and Coke Company, Ltd.

OBITUARY.

The death has occurred, at the age of 83 years, of Mr. William Moys, of Ossett, formerly a well-known gas engineer in West Yorkshire, and for many years past, since retirement, an active figure in public life at Ossett. As a youth he entered the employ of the Wakefield Gas Light Company, and eventually became Manager to the Ossett Gas Company—a position he retained until that undertaking was purchased by the Ossett Corporation in 1901. For many years past he had been a member of the Ossett Town Council.

The death occurred on Sept. 25 of Mr. Edwin Alfred Wright, a former Managing Director of the Brecon Gas Company, Ltd. Mr. Wright, who served the Company as Secretary before being appointed Managing Director, was a member of the Brecon Town Council for nearly fifty years. He was Mayor in 1886, and was created an Alderman in 1895. Owing to ill-health, he had to resign from the Council about two years ago, and also had to give up his duties as a Justice of the Peace for the borough, and as a County Magistrate. Deceased was a prominent Freemason.

FORTHCOMING ENGAGEMENTS.

Oct. 5.—North of England Gas Managers' Association.—Meeting. Presidential address of Mr. D. Currie.

Oct. 6.—Manchester and District Junior Gas Association.—Annual meeting in the Town Hall, Rochdale. Presidential address of Mr. H. J. Hailstone, A.M.I.Chem.E. Inspection of the Rochdale Gas-Works.

Oct. 6.—Scottish Junior Gas Association (Western District).—Meeting in the Royal Technical College, Glasgow, at 7 p.m. Presidential address of Mr. John Murray, of Glasgow.

Oct. 6.—Scottish Junior Gas Association (Eastern District).—Meeting in Edinburgh. Address by Mr. F. J. Dent, B.Sc.

Oct. 11.—Midland Association of Gas Engineers and Managers.—Autumn general meeting at the Imperial Hotel, Birmingham, 2.30 p.m. Discussion on maintenance to be opened by Mr. R. J. Rogers, of Birmingham. Discussion on "Gas Undertakings' Insurances," to be introduced by Mr. A. S. Foster, of Stourport.

Oct. 11.—Midland Junior Gas Association.—Meeting in the Council House, Birmingham. Presidential address of Mr. F. Caudwell.

Oct. 16.—Southern Association of Gas Engineers and Managers (Eastern District).—Meeting at 28, Grosvenor Gardens, S.W. 1, at 2.30.

Oct. 17.—Manchester District Institution of Gas Engineers.—Meeting in Manchester. Visit to the works of Messrs. R. & J. Dempster, Ltd. Paper by Mr. William Buckley on "The Maintenance Costs of Vertical Retorts."

Oct. 18.—Eastern Counties Gas Managers' Association.—Autumn meeting in London.

Oct. 20.—Scottish Junior Gas Association (Western District).—Visit to the Kingshill Colliery of the Coltness Iron Company, Ltd.

Oct. 22-24.—British Commercial Gas Association.—Annual Conference at York.

Nov. 14.—Southern Association of Gas Engineers and Managers.—General meeting at the Hotel Cecil, Strand, W.C. 2, at 2.15 p.m.

Nov. 22.—Society of British Gas Industries.—Autumn general meeting. Hotel Cecil.

The Institution of Gas Engineers.

All meetings take place in the Council Room at 28, Grosvenor Gardens, unless otherwise stated.

Oct. 9.—Gas Education Committee.

Oct. 10.—Finance and Executive Committees in the morning; Corrosion of Pipes Committee in the afternoon.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

GENERAL MEETING AT PORTHCAWL.

There was a gratifying attendance of members in the Council Chamber, Porthcawl, on Thursday last, Sept. 27, when the meeting was called to order by Mr. D. WALTER DAVIES, of Tredegar, the Retiring President. The proceedings opened with a hearty welcome to the town by Councillors Davies and Griffin, which was acknowledged by the President.

THE MINUTES.

The HON. SECRETARY (Mr. Octavius Thomas, of Pentre) read the minutes of the last general meeting; and they were confirmed. He also announced the receipt of a number of letters of apology for absence, including one from Mr. John Terrace, the President of The Institution of Gas Engineers, who expressed his regret that, as he had to preside at one of the sessions of the World Power Fuel Conference on that day, it would be quite impossible for him to be present. He sent his wishes for a successful gathering, and said he hoped that, on the occasion of one of their future meetings, the Wales Institution would give him an opportunity of endeavouring to be present.

THE NEW PRESIDENT.

Mr. DAVIES remarked that the new President, Mr. F. Boardman, of Cardiff, hardly required any introduction from him. He was well known to all the members, many of whom had had experience of his great courtesy. The fact that he came from Cardiff was quite sufficient recommendation, and he had much pleasure in asking him to take the chair.

Mr. FRANK BOARDMAN (Chief Assistant Engineer to the Cardiff Gas Light and Coke Company) then took the chair, amid applause, and said he regarded it as a privilege to convey to the Retiring President the hearty thanks of the Institution for his services during his year of office. They would long remember his Presidential Address, and the interesting and enjoyable visit to Tredegar. He moved a cordial vote of thanks to him.

Mr. J. MOGFORD (Cardiff) said it was a pleasure to second this. Mr. Davies was to be congratulated upon the manner in which he had conducted the business of the Institution; and the Institution was to be congratulated upon having experienced a very successful year during his period of office. In the course of the proceedings which followed their last meeting, the General Manager of the Tredegar Coal and Iron Company put it to them as an Institution that the coal industry was looking to them to help in a solution of the troubles through which the coal industry was passing to-day. It was pleasant to know that one member of the Institution was endeavouring to do so. He thought that at the close of the present meeting Mr. Davies would be able to go back with a message to the General Manager of the Tredegar Coal and Iron Company that they had had an excellent paper in the direction which that gentleman had indicated.

Mr. DAVIES, acknowledging the vote, declared that his year of office had been a most pleasant one; but any success he had had was largely due to Mr. Thomas. The past year had been unique, inasmuch as they had enjoyed the honour of a visit to Wales by the parent Institution. In this connection also their own Institution, through the Hon. Secretary, did valuable work.

PRESIDENT'S MEDALLION.

The PRESIDENT said it was next his pleasure, on behalf of the members, to present to Mr. Davies the Institution's medallion, as a souvenir of his year of office. Mr. Davies had carried out his duties with credit, and had won the esteem of the whole body of members. [Applause.]

CERTIFICATES AND PRIZES FOR THE JUNIORS.

The PRESIDENT said they now came to the presentation of the Higher Grade Certificates in Gas Engineering and prizes to members of the Wales and Monmouthshire Junior Gas Association. He would ask Mr. Madden to make the presentations.

Mr. Madden then proceeded to present the certificates and prizes as follows:

For having passed the Higher Grade in Gas Engineering, Second Class.

A. C. Parker, Cardiff, certificate, also prize.
J. G. Chilcott, Swansea, certificate.
S. Jones, Swansea, ,,

For work done for the Wales and Monmouthshire Junior Gas Association.

T. V. Blake, Manchester, prize.
H. D. Hazell, Newport, ,,
W. T. Lane, Cardiff; ,,
T. Noall, Cardiff, ,,
C. S. Thane, Newport, ,,

For having passed the Ordinary Grade in Gas Engineering.

W. H. T. Johns, Swansea, prize.
H. V. Williams, Cardiff, ,,
G. A. Mogford, Cardiff, ,,

For having passed Ordinary Grade in Gas Supply.

L. L. Kleist, Cardiff, prize.
J. H. Williams, Cardiff, ,,

For having passed the Internal Examination in Ordinary Gas Engineering, Cardiff Technical College.

A. J. Cruise, Cardiff, prize.
F. D. Thomas, Cardiff, ,,

For having passed the Final Examination in Gas Fitting, City and Guilds of London Institute.

W. G. Biggins, Newport, 1st Class with distinction, 1st prize, and Silver Medal, prize.
C. G. Fletcher, Newport, 2nd Class, prize.

For having passed Grade 2 Examination in Gas Fitting, City and Guilds of London Institute, 1st Class.

W. Bannister, Newport, prize
J. H. Betts, Newport ,,
J. F. Carless, Newport ,,
T. E. Wiltshire, Newport ,,

For having passed Grade 1 Examination in Gas Fitting, City and Guilds of London Institute.

B. Lenahan, Newport, prize
L. C. Vickery, Newport ,,
T. F. Edwards, Newport ,,
J. J. Asquith, Newport ,,

Mr. MADDEN said he had got great insight into this matter of education through having been for some years Chairman of the Board of Examiners of the Institution. He thought they could all see now how important it was that the junior should be well trained, and so could realize their duty in the matter more clearly perhaps than was at one time the case. They had only to visualize the progress made in (say) the last twenty years in gas engineering and gas supply to appreciate the urgent need for education. When he said "education," he did not altogether mean it in the sense that some people regarded it. What he had particularly in mind was the need for training men to think technically and scientifically. He had been much struck by a remark of Lord Melchett, the Chairman of the National Fuel and Power Committee, in reporting to the Government. Lord Melchett laid stress on the fact that the coal industry, like the gas industry, required highly technically trained minds for research work. Research was needed in small matters, as well as in big. He appealed strongly to the members of the Wales and Monmouthshire Junior Association to go on with their studies, and so to equip themselves that they might think-out their problems for themselves. They must in every way fit themselves for the positions which would be open to them. It was a pleasure to their Institution to give these prizes as an encouragement; but the very proper condition was laid down that the recipients must be members of the Junior Association. This was the very essence of the scheme. They wanted to get all the juniors into the Association, with the object of furthering the cause of true education. He sincerely complimented the students upon their work, because he knew that the examination papers to-day were on a higher plane, and those who passed did so with great credit to themselves.

The PRESIDENT thanked Mr. Madden for distributing the prizes and for his sound advice, the following of which would be to the benefit of the students and of the gas industry at large.

REPRESENTATIVE ON THE PARENT COUNCIL.

On the motion of Mr. DAVIES, seconded by Mr. W. H. JOHNS (Swansea), Mr. Boardman was appointed to represent the Institution on the Council of The Institution of Gas Engineers for the year commencing in June, 1929.

SPECIAL PURPOSES SECTION.

The eighteenth annual report of the Special Purposes Section, which was signed by the Chairman (Mr. James E. Kenshole) stated that two meetings had been held since the last report, and the membership remained the same. Fortnightly reports of coke stocks, together with the prices received, had been circulated, and by these means improved prices had been obtained. During the year the British Road Tar Association had been formed, with the object of increasing the use of tar on the roads, &c.; and the Committee hoped those members who had not already joined would do so. The Committee wished again to draw the attention of the members to the Gas Education Scheme, as they did not consider sufficient use was made of it. The juniors who had made use of it had in many cases benefited by the appointments obtained. The Committee hoped the managers of the different undertakings would give every facility and encouragement to their assistants and juniors to attend the classes. Prizes had been given to the successful candidates; and these had been much appreciated. The receipts for the year amounted to £44 8s. 6d., and the payments to £41 15s. 4d., leaving, with the balance brought forward, the

sum of £77 4s. 1d. in the hands of the Treasurer, together with £200 of 2½ p.ct. Consols.

An Appeal for Facilities for the Juniors.

Mr. W. Clark Jackson (Neath), proposing the adoption of the report, drew attention to the satisfactory financial position of the Section, and said that out of the balance in hand it was intended that a further £60 should be invested in 2½ p.ct. Consols. He went on to emphasize the remarks made in the report with regard to the students. The Council felt that sufficient interest was not shown by gas undertakings in giving facilities to the young men employed by them to attend the classes at Cardiff and also to join up with the Junior Association and take part in their proceedings. As Mr. Madden had pointed out, it was essential that education in the industry should continually progress, if the industry was to hold its own against the competition which was becoming keener as the years went on. They must look to the young men in their midst to help them; and for this purpose the juniors must be highly educated. Directors and Committees must be impressed with the idea of education, so that they might be willing to sanction the granting of the necessary facilities to those in their service to attend the classes and Junior Association meetings from which they would derive great benefit. The Salesmen's Circle was another branch of activity which they must back up wholeheartedly. Considering the extraordinary importance of salesmanship at the present day, it should be hardly necessary to emphasize the fact that every encouragement must be given to the members of the staff on that side to join up and attend the meetings. It would not cost much, and the expenditure that was involved would be money well spent, in securing better service with its attendant beneficial results.

Mr. R. J. Auckland (Cardiff) seconded the motion for the adoption of the report; and it was unanimously agreed to.

The Gas Salesmen's Circle.

The Hon. Secretary said he had received the following letter from Mr. R. J. Williams, the Hon. Secretary of the South Wales and Monmouthshire Gas Salesmen's Circle:

Dear Sir,—My Committee respectfully request you to bring before the members of your Association the matter of attendances at the Gas Salesmen's Circle. The meetings are well attended by members from just a few undertakings; but the majority of undertakings are rarely represented.

The following views were expressed by members during the discussion of this subject: The increased activities of our competitors increases the need for increased knowledge and enthusiasm on the part of the gas salesman. The greatest defaulters are small undertakings who stand to lose most by electrical competition, due to the large proportion of lighting load. In addition to knowledge obtained from papers and lectures, great benefit is derived from the intercourse of members from various towns. Arising from the appeal to the Executive of the British Commercial Gas Association for educational facilities for gas salesmen, Mr. F. W. Goodenough suggests that, while the matter is being considered, the best use should be made of the Salesmen's Circle for the training of salesmen.

For the information of your members, the following programme has been arranged for the next session: Gas lighting; ventilation; salesmanship and education; refrigeration; electrical competition; and disposal of residuals.

Low-Temperature Carbonization.

Mr. David Muir, Engineer and Manager of the Pontypridd Gas-Works, then read a paper on "Low-Temperature Carbonization," which, with a report of the discussion, will be found later in this issue.

Thanks to the Council.

On the proposition of Mr. J. E. Kenshole (Merthyr), seconded by Mr. A. J. Bond (Aberavon), the Porthcawl Urban District Council were thanked for the loan of their Council Chamber; and it was decided that the decision as to the place of next meeting should be left to the Council.

Thereafter the members had lunch together in the Esplanade Hotel. Mr. Madden proposed "The Town and Trade of Porthcawl," which was responded to by Councillor Jenkyn Jones. Councillor Davies submitted "The Wales and Monmouthshire District Institution of Gas Engineers and Managers," and apologized for the enforced absence of Councillor Russell Mabley, the Chairman of the Gas Committee. The toast was acknowledged by the President.

Golf Competition.

On the day preceding the meeting, the Institution's golf competition was played in perfect weather at the Royal Porthcawl Golf Links; the arrangements made by the Royal Porthcawl officials being very satisfactory. Eighteen competitors took part, and several of the gas engineers of the District witnessed the game. The replica of the cup was presented by Mr. T. B. Walker, of Messrs. Gibbons; and Mr. J. M. Kemp, of Messrs. Fletcher, Russell, & Co., Ltd., gave a golf bag as a second prize. The following were the best scores:

R. R. Bird	94 – 12 = 82
W. C. Jackson	88 – 4 = 84
T. B. Walker	98 – 14 = 84
S. C. Whitfield	104 – 20 = 84
S. Sadler	101 – 14 = 87
E. S. Allen	102 – 13 = 89
J. S. Burgoyne	105 – 12 = 93

BRITISH INDUSTRIES FAIR.

Progress in the Gas Section.

We understand that good progress is being made with the organization of the Gas Section at the British Industries Fair which is to be held in Birmingham from Feb. 18 to March 1 next year. The position allotted to the Gas Industries Section last February, in the centre of Building AA, has been retained and extended. The value of the site has been still further increased in that the new dining room, capable of seating 2000 diners, which is to be available for next year's Fair, will open directly into the Gas Section.

Already the space allotted to intending exhibitors exceeds the total space occupied by the Section last year, and it is expected that within the next two or three weeks all the space available will be taken up. As practically all space in the building outside the Gas Section has already been booked, those firms who delay their decision may find themselves unable to obtain accommodation.

This year the Gas Section has the advantage of active support from all the national organizations connected with the gas industry. At the present time consideration is being given to the holding of a gas conference, at which it is hoped that sessions will be arranged where matters of interest to the National Gas Council, The Institution of Gas Engineers, the British Commercial Gas Association, and the Society of British Gas Industries may be discussed. Such a conference, together with the attraction of the enlarged exhibits provided by manufacturers in the industry, should draw an even greater number of gas engineers and administrative chiefs to Birmingham during the period of the Fair.

The annual meeting of the Gas Salesmen's Circles will take place at Birmingham on Feb. 27 and 28; and an official visit will be paid to the Fair by the salesmen.

It would appear, therefore, that those attending the Fair will have excellent opportunities for the interchange of ideas and experiences, and there was never a time in the history of the industry when such mutual interchange was more needed. Matters of the utmost importance are now under discussion, and it is essential that advantage should be taken of all opportunities such as are afforded by this exhibition, and by the annual meetings of The Institution of Gas Engineers and of the British Commercial Gas Association, by those who wish to keep *au fait* with developments in their industry.

There is no doubt that this co-operative display of gas appliances gives an excellent opportunity for gas engineers and managers to see the latest products the manufacturers have to show; and buyers of gas plant and appliances are thus able to handle and examine the most up-to-date apparatus, rather than having to depend upon descriptions or catalogue illustrations.

In addition there is at the forthcoming Fair a very extensive display of electrical appliances; and a good knowledge of what our competitors are doing is of the greatest possible value to all who are working to promote the progress of our industry.

Application for any of the small amount of space still available in the Gas Industries Section should be made at once, and addressed to Mr. R. J. Rogers, Hon. Secretary, Gas Industries Section, British Industries Fair, at the Gas Department, Council House, Birmingham.

SHOP LIGHTING BY GAS.

In view of the vigorous articles which have appeared in our columns recently in regard to the need for the gas industry to devote due attention to the lighting load, it is gratifying to learn that several important contracts have been received for the lighting of shops and business premises in London and the Provinces by Keith 1000 and 1500 c.p. lamps.

As a result of the effect of Keith lamps for shop lighting in a near-by district, the Rawmarsh Gas Department, of which Mr. S. A. Moorhouse is Manager, have co-operated with the shopkeepers in Rawmarsh, and contracted to supply them with 1500 c.p. lamps on the inclusive charge system for an agreed sum per lamp per annum, including installation, gas, and maintenance. A compressor has been installed, and new mains are being run. So far, contracts have been arranged for 75 lamps of the Keith No. 805 new pattern with parabolic reflectors. There are also, we understand, prospects of extending the system for street lighting later.

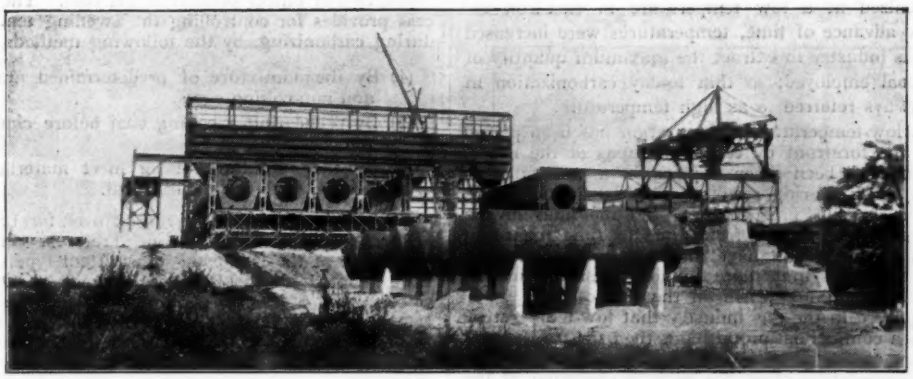
One important feature of this installation is that, though Rawmarsh is not a large shopping centre compared with many provincial towns who have adopted high-pressure shop lighting, it illustrates to what extent business can be acquired for gas lighting if co-operation is encouraged between the gas engineer and the shopkeepers.

Many extensions are being carried out in the areas of the Gas Light and Coke Company, and of the Manchester Corporation Gas Department. The James Keith and Blackman Company, Ltd., report that they are busy with installations for high-pressure lighting of factories, textile mills, &c.

LOW-TEMPERATURE CARBONIZATION FOR TOWN GAS SUPPLY.

"K.S.G." Plant for the New Brunswick Public Service Electric and Gas Company.

[Contributed.]



"K.S.G." RETORTS AND TAR TANKS UNDER ERECTION.

The "Journal" for Aug. 22 last contained an illustrated description of the "K.S.G." low-temperature carbonization plant at the Karnap Works of Mathias Stinnes. Mention was then made that a large installation on this system is being erected in New Jersey, to supply normally over 3 million c.ft. of town gas (530 B.Th.U. per c.ft.) to the New Brunswick Public Service Electric and Gas Company.

The accompanying photographs of the plant, which consists of eight retorts, show the present state of development. Each retort will have a throughput of 80 tons of coal per day on normal running—that is, 640 tons for the setting. In addition there will be a carburetted water gas plant. The whole plant is being installed and operated by the International Combustion Engineering Corporation of New York, who are to supply a guaranteed delivery of gas at an agreed rate into the mains of the New Brunswick Public Electric and Gas Company.

The Kohlenscheidungs Gesellschaft, of Berlin, was originally a project of the late Hugo Stinnes, but has since been taken over by the International Combustion Engineering Corporation; while both the "K.S.G." and the McEwen Runge low-temperature carbonization processes are handled in Great Britain by Coal Oil Extraction, Ltd., of London.

The site at New Jersey, 39 acres in extent, is on the banks of the Raritan River (township of Raritan), and the plant will turn out per day between 2 and 3 million c.ft. of gas of a calorific value of 800 B.Th.U. per c.ft. This is to be mixed with blue water gas to bring up the total to 4 million c.ft. of town gas of about 530 B.Th.U. per c.ft. The carburetted water gas plant on the site of the "K.S.G." installation will be capable of giving 3 million c.ft. of gas per day, operating on raw coal.

This "K.S.G." installation is particularly interesting to the town gas industry, for, in the unlikely event of a stoppage of the retorts, the minimum amount of town gas required can still be given without difficulty by operating the water gas generators at their maximum capacity on raw coal.

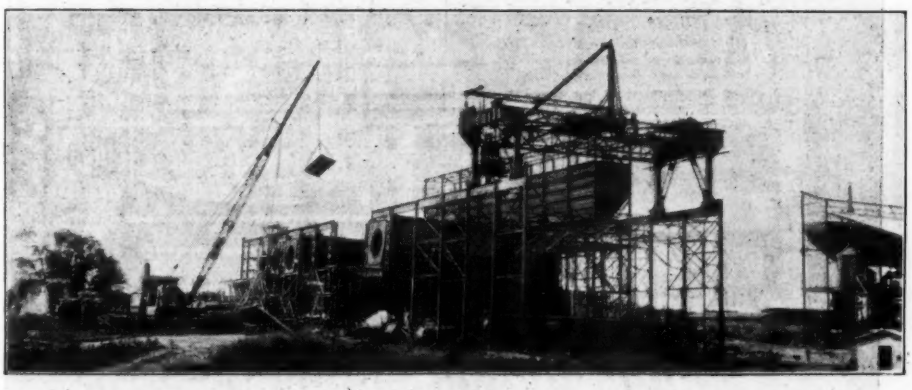
It will be remembered that the standard "K.S.G." retort is a rotary, slightly inclined, steel cylinder, 76 ft. long and 10 ft. in diameter, having an inner cylinder 5 ft. 8 in. in diameter, corresponding to a throughput of between 60 and 85 tons of bituminous small coal per 24 hours, with an overload of 100 tons. The speed of the retort is slow, averaging one revolution in 90 seconds; the total travel of the charge through both cylinders together being approximately 2½ hours.

The coal, as dust and smalls, enters at one end and travels—because of the rotary motion—along the inner cylinder, which also has a projecting spiral arrangement, during 1¼ hours, being raised to a temperature of 400° to 570° Fahr. Then the charge falls out through apertures into the outer cylinder, which at this end is the hottest zone, about 925° to 1025° Fahr. At the same time highly-superheated steam at 850° to 900° Fahr. is blown through the mass to the extent of about 5 p.ct. of the charge, and as a result of this sudden rise in temperature, combined with steaming, the plastic material does not expand unduly, and gives a dense smokeless fuel. The low-temperature carbonization is then completed in another 1¼ hours at the other end of the outer cylinder; the temperature slowly declining to about 800° to 900° Fahr.

With highly swelling coals, a certain amount of low-temperature fuel dust and breeze—not over 10 p.ct.—is blended with the raw coal, to prevent the plastic charge sticking to the retort walls. For heating the setting, low-grade producer gas is burnt in a small firebrick combustion chamber, and the resulting flames and hot gases (at 2372° to 3095° Fahr.) are diluted, not with air, but with inert combustion gases, to give a temperature of 1110° to 1290° Fahr. The gases are passed round the retort; and as no oxygen is present, corrosion and deterioration of the cylinder are prevented.

It is understood that a "K.S.G." installation, complete with bye-product plant, has been ordered for the Mines de Lens, in France, the first section of which will be one standard retort having a throughput of 80 tons per 24 hours. In this case the coal to be used consists of bituminous dust and smalls from the Lens Mines. This coal will average 30 p.ct. of volatile matter, 2·2 p.ct. of water, and 5·5 p.ct. of ash.

A second "K.S.G." plant is to be installed in Germany (not at Essen), while it is more or less an open secret that a "K.S.G." unit is at present under construction in Great Britain, at a well-known gas-works in London.



END VIEW OF THE INSTALLATION.

LOW-TEMPERATURE CARBONIZATION.

By David Muir, Engineer and Manager of the Pontypridd Gas-Works.

[Before the Wales and Monmouthshire District Institution of Gas Engineers and Managers on Sept. 27.]

Low-temperature carbonization requires no introduction to the gas industry, as in the earliest days of gas manufacture the coal was carbonized at a low temperature in cast-iron retorts. With the advance of time, temperatures were increased to enable the gas industry to extract the maximum quantity of gas from the coal employed, so that to-day carbonization in gas-works is always referred to as high temperature.

Of late years low-temperature carbonization has been placed prominently in the forefront by certain sections of the Press, and on occasions has been given a place in a political programme, while most alluring results from its adoption have been held out in various prospectuses. To the man in the street the statements appearing from time to time regarding low-temperature carbonization have made an impression, but gas engineers have felt that more reliable information was necessary to make them lukewarm on the subject.

If it can be proved to the gas industry that low-temperature carbonization is a commercial proposition, then the project will have the support of our great industry. For some time, the McLaurin low-temperature plant has been in operation at the works of the Glasgow Corporation; and a plant is being erected by the Gas Light and Coke Company, proving that the industry is endeavouring to explore the possibilities of low temperature. South Wales can also claim to have a low-temperature plant in operation at a gas-works; and it is to the working of this plant that I wish to give you unvarnished information which I have gained from personal contact with it.

Low-Temperature Plant at Treforest.

In the summer of 1923, the Illingworth Carbonization Company, Ltd., approached my Council with a request to carry out experiments on low-temperature carbonization at the Treforest Gas-Works. An agreement was entered into for this purpose, and in November, 1923, the Company commenced adapting the plant to their requirements. By the winter of 1924, they were producing fuel and marketing it under the name of "Ricoal." Since then, the plant has worked continuously with the exception of the period of the coal stoppage in 1926.

This particular plant was designed primarily with the object of carrying out experiments on various classes of coal and discovering its commercial potentialities, as Dr. Illingworth was convinced, after several years of research, that his method of low-temperature carbonization would produce a hard, smokeless fuel suitable for domestic or commercial purposes. The plant in question is capable of producing 50 tons of smokeless fuel per day.

Swelling of the Coal.

In the course of experiments, Dr. Illingworth realized that one of the main difficulties in a low-temperature process was the swelling of the coal. It is known that coking coals swell when heated, and the amount of swelling usually indicates the proportion of binder present in the coal. The Illingworth process provides for controlling the swelling tendency of the coal during carbonizing, by the following methods:

(1) By the admixture of predetermined amounts of coking and non-coking coals.

(2) By preheating a coking coal before charging it into the retorts.

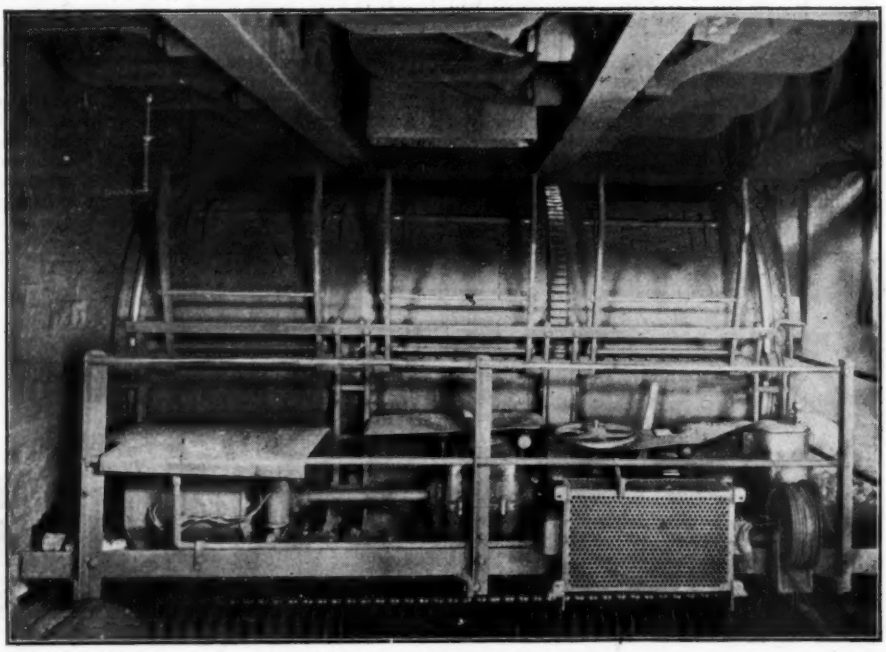
(3) By the admixture of an inert material, such as coke breeze, with the coking coal.

The Illingworth Company took over for their work the old beds of vertical retorts at the Treforest Gas-Works. These beds were of the Dempster intermittent type, and two of them were adapted for the Illingworth process. One bed has three retorts 8 ft. 6 in. across the front, and the second bed four retorts 11 ft. 6 in. across the front. Each retort consists of 18 **H** section, cast-iron conductors, each of which is 12 ft. high, 14 in. wide, and 9 ft. 6 in. long. The sections are tapered from top to bottom, a matter of 1½ in. in the 12 ft. The carbonizing period averages 1 hour per inch width of the retort from the centres. Thus a 7-in. retort would require 7 hours. The capacity of each retort is 30 cwt.

The cast-iron conductors or sections making up the retort are in three groups consisting of six retorts in each group, or 18 in all. The flues are of high silica fireclay; those in No. 2 setting being of the single type, and those in setting No. 1 of the double type. The weight of material in the retorts is supported by rotary doors which are not gas-tight, the gas-tightness being secured by sliding doors situated below the rotary doors. Coal is charged into the retort from weighed hoppers through tubular funnels, which ensure a clear passage into the retorts.

After carbonization, the "Ricoal" is dropped into a drum which contains a weighed quantity of wet washed smalls. This coal contains 8 to 10 p.ct. of moisture, and is ⅛ in. to 0 in. in size. The doors of the drum are closed mechanically, and the drum is rotated five revolutions. The result is that the hot "Ricoal" dries the virgin coal, the drum acting as a heat exchanger. The mixture is then tipped into a pit where the large pieces are cut for marketing, and the mixture is screened on a bar screen. It is found that only about 7 p.ct. of breeze is made, and this largely by the cutters. The "Ricoal" contains about 8 p.ct. of volatile matter. It will be noted that the drum acts as a transporter, mixer, cooler, and dryer. All these operations are carried out mechanically, and a 5-H.P. motor serves for all duties.

The mixing of the raw coal with the hot "Ricoal" fulfils three functions. First, it provides an automatic blend; secondly, it reduces the moisture content of the coal at mini-



VIEW OF DRUM.

mum cost and trouble; thirdly, the "Ricoal" is cooled rapidly and without the addition of water, thus eliminating black ends and reducing breakage.

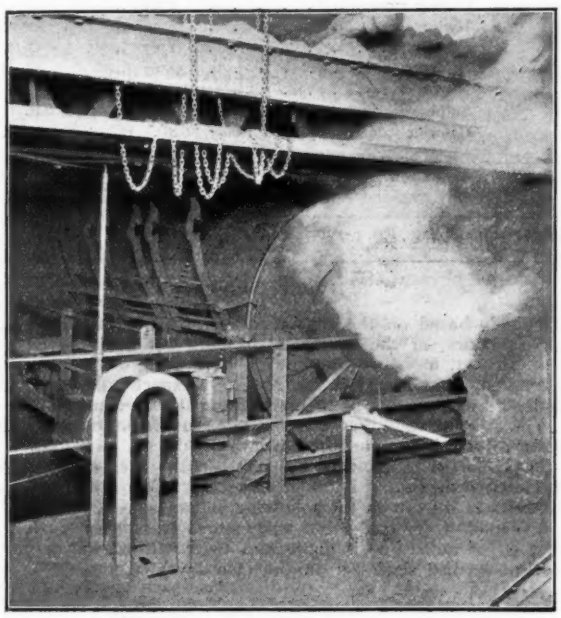
The use of cast-iron sections allows for a rapid transmission of heat from the flues to the charge, both by conduction and radiation; and the efficiency of this means is shown by the rapidity of carbonization. The control of the heats in the flues is very simple; the damper at the main flue being the chief control. The temperature in the combustion chambers is maintained at about 700° C., dropping to 650° C. in the top section. In the carbonization chamber, the temperature is between 600° and 620° C. The accompanying drawings give a general idea of the plant.

Provision is made for heating the retorts by producer gas or by gas manufactured in the plant.

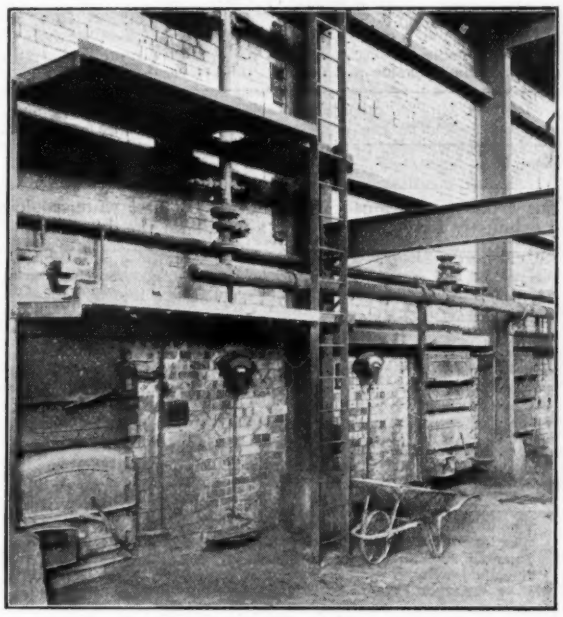
The following are results obtained from actual tests on the plant:

Analysis of Coal Used.

Moisture	9·6 p.ct.
Volatile	35·0 ,,
Ash	4·63 ,,
Caking index	18
Calorific value (dry coal)	15,840 B.Th.U. per lb.
Sulphur	1·3 p.ct.



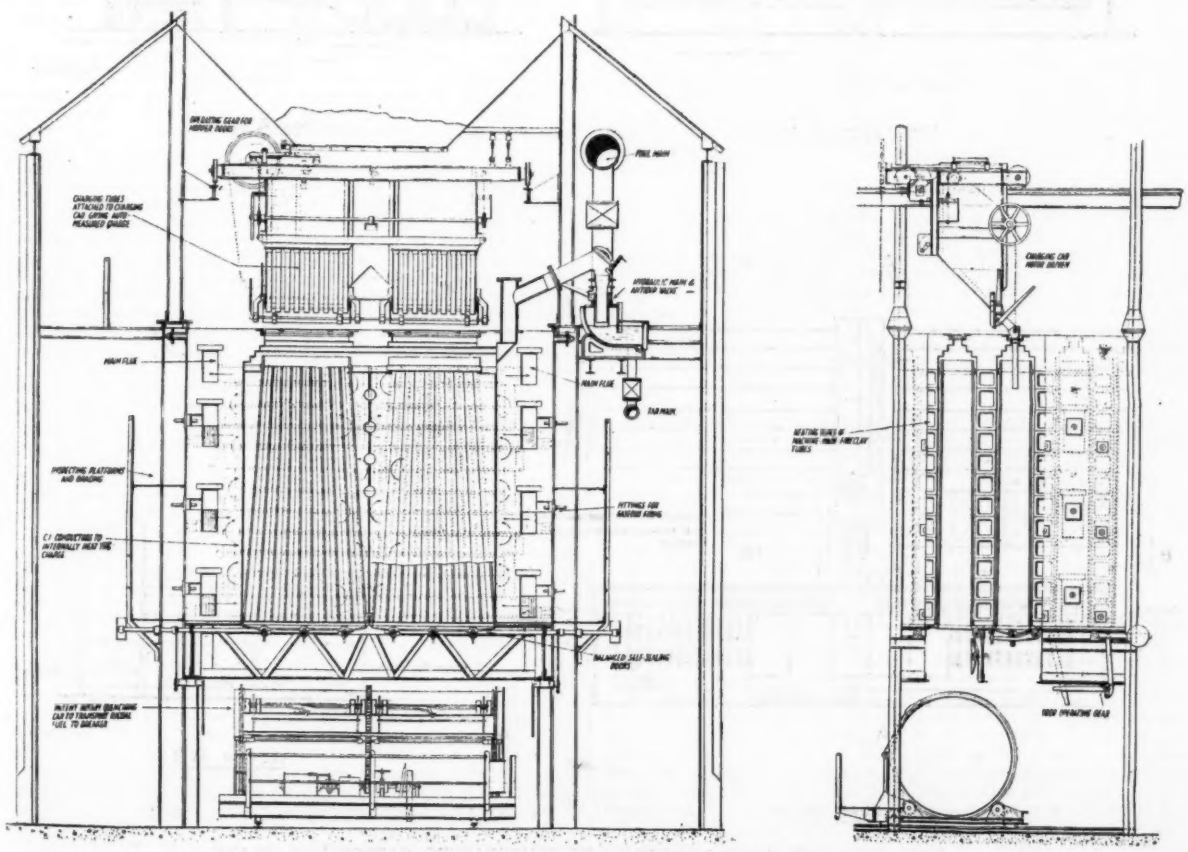
View of Drum in Operation.



Front View of Benches.

Screening Test of Coal Used.

Over ¾ in.	1·85 p.ct.
¾ to ½ ,,	16·5 ,,
½ to ¼ ,,	11·92 ,,
¼ to ⅛ ,,	54·1 ,,
⅛ to 1/10 ,,	7·34 ,,
Under 1/10 in.	8·25 ,,
	99·96 p.ct.



ILLINGWORTH LOW-TEMPERATURE CARBONIZING PLANT.

Results of Carbonization.

Fuel.	Dry Coal Basis.	Wet Coal Basis. (10 P.Ct. Water.)
	Cwt. Qrs. Lbs.	Cwt. Qrs. Lbs.
Over 2 in.	13 1 0	12 0 0
Nuts, 2 in. to ½ in.	1 1 0	1 0 14
Breeze, under ½ in.	0 2 0	0 1 25
Total	15 0 0	13 2 11

Analysis of Fuel.

Moisture	0·7 p.ct.
Ash	6·6 ,,
Volatile	8·6 ,,
Calorific value	14,168 B.Th.U. per lb.

Tars.	Dry Coal Basis.	Wet Coal Basis (10 P.Ct. Water).
Crude	17·5 galls.	16·0 galls.

The crude tar obtained from the air coolers, water-coolers, and exhauster have the following analysis on the dry tar:

Fraction.	Percentage by Volume.	Specific Gravity of Faction at 60° Fahr.
°C.		
0–170	10·25	0·856
170–200	12·9	0·959
200–230	11·2	0·98
230–260	9·8	0·991
260–290	11·7	1·005
290–320	8·4	1·029
320–350	7·2	1·055
350–400	8·5	1·11
Pitch by difference	20·05	,,

The original gravity of the tar, 1·045.
The tar settled after 12 hours to a moisture content of 5 p.c.t.
Phenolic substance in the tar equals 30.
Specific gravity, 0·85.

—	Dry Coal Basis.	Wet Coal (10 P.Ct. Water) Basis.
Liquor	11 galls.	22 galls.
Benzole	4 ,,	3·6 ,,
Gas, per ton of coal	5900 c.ft.	5300 c.ft.

Analysis of Gas.

Carbon dioxide	4·26 p.ct.
Oxygen	1·11 ,,
Carbon monoxide	1·67 ,,
Hydrogen	18·21 ,,
Ethylene	1·67 ,,
Methane	54·67 ,,
Nitrogen	16·41 ,,
Sulphur	0·14 grains per c.ft.
Calorific value (Simmance Abady)	680 B.Th.U. per c.ft.

—	Dry Coal Basis.	Wet Coal (10 P.Ct. Water) Basis.
Ammonium sulphate, lbs. per ton	8	8

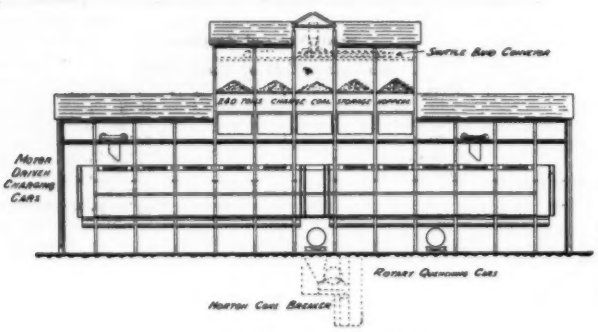
BALANCE-SHEET.

This is based on the carbonization of 220 tons of dry coal per 24 hours, or the equivalent amount 242 tons of wet coal with 10 p.ct. moisture content. The working days per annum are taken as 300, but one can naturally expect full years' work under normal conditions of market and labour tranquillity.

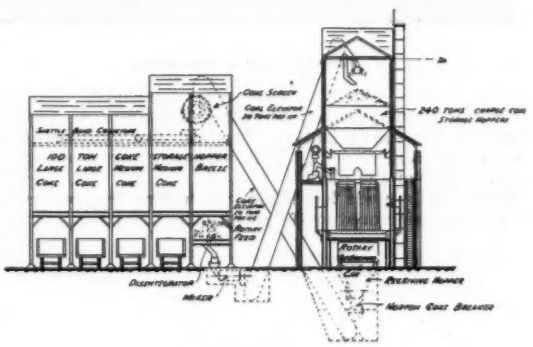
The average capital cost is 15s. per ton per annum, as initial outlay, but it is less for lower volatile coals.

Depreciation is taken at 14½ p.ct. on the over-all costs, and the interest on capital is taken at 5 p.ct. The price of the commodities is set out in the following balance-sheet.

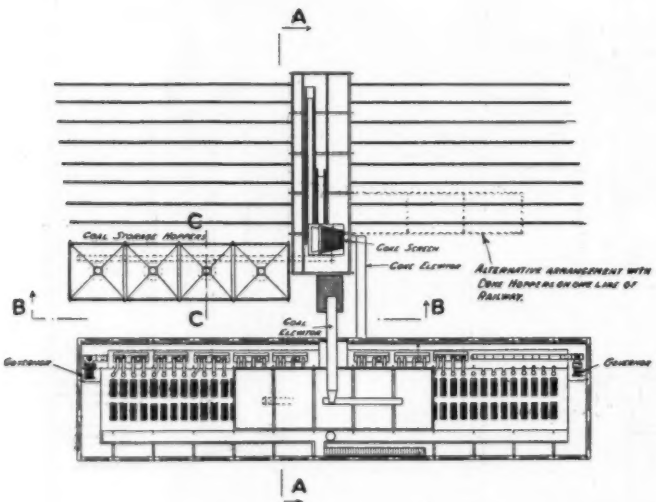
220 tons of dry coal—that is, 242 tons of washed slack with 10 p.ct. of moisture—is equivalent to the utilization of 72,600 tons of washed slack per annum (300 days).



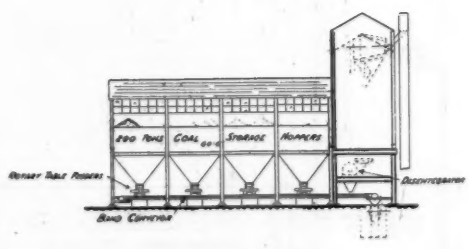
LONGITUDINAL ELEVATION



SECTION A A



PLAN



SECTION B B

200-TON PER DAY "ILLINGWORTH" LOW-TEMPERATURE CARBONIZING PLANT.

	£		£
Coal—		Fuel—	
72,600 tons at 10s. . . .	36,300	42,900 tons large at £1 .	42,900
Operating costs—		4,125 tons nuts at £1 .	4,125
Wages, power, stores, renewals, depreciation, management, and capital at 6s. 3d. per ton, inclusive of benzole refining	22,688	1,650 tons breeze at 5s. .	400
		Tars—	
		1,056,000 galls. at 4d. . .	17,600
		Benzole—	
		264,000 galls. at 1s. . .	13,200
		Gas surplus—	
		2500 c.ft. per ton at 5d. .	3,300
	£58,988		
Balances . . .	22,537		
	£81,525		£81,525

Profit per ton of wet coal = 6s. 2d.

In the above balance-sheet, attention is drawn to the matter of gas. It is, of course, assumed, in taking gas on credit at 5d. per 1000 c.ft., that it will be purchased by the local gas undertaking. The amount of gas taken on credit is the surplus gas after the normal quantity has been utilized for heating the retorts. No credit has been taken for sulphate of ammonia, as the production of synthetic ammonia renders the utilization of liquor problematical.

When one compares the yield of gas per ton of coal carbonized with that obtained in up-to-date gas-works practice, one feels that this method of carbonization would be useless where gas is the primary object.

It may be that any of the larger undertakings which have a demand for a good solid fuel could work a low-temperature plant in conjunction with their existing plant and thereby utilize the higher grade gas. The success of a plant depends on the market for its commodities and the price to be obtained. It is a fact that the above-mentioned plant is situated in the coalfield where there are also plentiful supplies of gas-works coke, coke-oven coke, and gas. Nevertheless a ready market has been found for the "Ricoal" produced.

I have brought samples of "Ricoal" for your inspection, so that you can form your own opinion of its potentialities. If any of the members wish to see the plant in actual operation, arrangements can be made with the Illingworth Company to give the necessary facilities.

Discussion.

The President (Mr. F. Boardman, of Cardiff) said they had all listened with great interest to a paper upon which the author was to be heartily congratulated. As they were aware, an important conference was now taking place in London at which the subject dealt with by Mr. Muir would, along with others, be discussed. It was, indeed, a matter which was largely in people's minds at the present time.

Mr. H. D. Madden (Cardiff) remarked that he believed this was the first paper on low-temperature carbonization that had been read at a meeting of their Institution. The thanks of the members were due to Dr. Roy Illingworth and to Mr. Muir for giving them an opportunity of discussing the question. He (Mr. Madden) had had the privilege of seeing this plant in the company of Dr. Illingworth and several colleagues in the industry. He would like to compliment Dr. Illingworth upon the ingenuity of the plant at Treforest, and particularly upon the method of heat transmission to the charge by means of joists. They appeared to stand up to the work well; and it seemed to be a very practical means of securing penetration of heat to the coal charge.

There was, however, another aspect of the question. The subject of low-temperature carbonization was to-day receiving everywhere a good deal of attention. In fact, carbonizing systems in general were under review. He had said in his Presidential Address to The Institution of Gas Engineers: "It is apparent from the Daily Press that a great and growing interest is being taken by the public generally in the carbonization of coal, and the provision of oils, tars, and fuels from this process. A greater perspective and vision obtains to-day on this matter. Some few years ago, the glamour of the word 'electricity' for all purposes overshadowed the truth of the practice of the proper utilization of coal for national and domestic needs. Not only the public, but leading politicians are now turning their interest to the carbonization of coal in one form or other; and it is apparent that there has been a general awakening to the great future possibilities of the processes we adopt for the treatment of coal." It had been seen recently that public interest was very much centred in carbonization. The gas industry had not yet employed low-temperature carbonization except in its earlier days, when it was the custom to employ a very low temperature for gas production. He, however, understood that the Gas Light and Coke Company were at present erecting a plant at Richmond, which they were going to test-out on a big commercial scale, in order to ascertain the possibilities of the process in connection with an undertaking supplying gas for town purposes.

Low-Temperature Carbonization Plant as an Auxiliary.

There was one thing that appealed to him as needing careful consideration in connection with low-temperature carbonization—whether such a plant could stand by itself as the sole gas producing agent for any undertaking. Another point that had to be taken into account was the quality of the gas produced by low-temperature carbonization. In the paper before them, he saw the calorific value was given at 680 B.Th.U., but if one carbonized some of the richer coals, and used the temperature stated by the author, he was rather inclined to think that the result would be a calorific value of something nearer 800 B.Th.U. From the investigations that were made in connection with the passing of the Gas Regulation Act, 1920, which provided for the sale of gas on the thermal basis, he thought it had been found that a calorific value of something like 500 B.Th.U. was generally best suited for domestic requirements and for industrial work. This was a very important point. If they were going to distribute 500 B.Th.U. gas, and they made 700 or 800 B.Th.U., there must be a water gas plant as an auxiliary. Then again, he saw, according to the paper, that the idea was to conserve as much as possible of the fuel for sale. If the coal gas was very rich, it seemed rather a pity to put it under the retorts, or to employ this specially manufactured fuel to carry out the carbonization process. Therefore it followed that they must have another auxiliary plant which would produce the hard coke necessary for making the water gas and for heating the generators.

Effect upon Oil Imports.

This was how the whole subject appeared to him; but they had to view the question also from another angle. Their great industry imported into this country huge quantities of crude oil for making carburetted water gas; and they had to examine the low-temperature carbonization problem from this standpoint. Would the provision of this very rich calorific value gas by means of a low temperature carbonization process (though it would have to be brought down to a proper standard by means of carburetted water gas or high-temperature carbonization) displace that huge quantity of gas oil which had now to be imported from abroad? If it did do this, it would fulfil a big mission by utilizing the coals of this country in place of the foreign oil. These were the chief points which were raised in his mind after thinking over the matter a good deal. The pith of the paper was to be found on the last page, where Mr. Muir stated, as he himself had done in his Presidential Address, that if low-temperature carbonization could be found a commercial proposition, then the gas industry would be in the forefront in adopting it.

Mr. W. H. Johns (Swansea) remarked that he hoped, if it was possible for the Association to be privileged to visit the plant at Treforest, that the members would turn up in large numbers. Mr. Madden had touched on most of the technical points raised in the paper, and of course the subject would receive further discussion at the conference which was being held in London.

Some Figures.

Mr. J. E. Kenshole (Merthyr Tydfil) said the paper contained so many figures that one required some time to consider it; but towards the end of the paper he noticed figures very much like those which cropped up year after year. One came across figures showing a profit of anything from 40 to 50 p.ct.; and those given by the author worked out at approximately 40 p.ct. The shareholders who had invested money in these low-temperature carbonization processes for a good many years past would be very glad to see 4 p.ct. return on their money, let alone 40 p.ct. There had been an enormous amount of money lost; but this did not necessarily mean that the system was not going to be profitable. What they had got to do now was to satisfy themselves as to whether it could be made a financial success. If it could, there was no doubt the gas industry would proceed with the matter. Carbonization at present occupied a prominent place in people's minds, and almost every day one saw in the papers different ideas expressed. For instance, only that morning he had been rather amused to see a communication to a local paper, in which the writer said it would appear highly desirable that in every case in which the gas supply of a district was drawn mainly from coke ovens, the ovens should be operated by the gas undertakers instead of by the colliery owners. Really one heard so many things proposed that one sometimes wondered what was going to happen. The Government were in difficulties regarding the coal industry, and were trying to do what they could to assist it; but it seemed that people were going to work in rather a peculiar way in suggesting that the gas industry should be compelled to take the gas from the coke oven industry and distribute it. If this happened, there would be so much less coal required.

A Few Questions.

Mr. J. H. Canning (Newport) proposed a hearty vote of thanks to the author for his paper, and said there were one or two questions he would like to ask. Mr. Muir was to be congratulated upon his contribution, and they also, as an Institution, were to be congratulated on having had placed before them a communication so particularly appropriate at the present time. He would like to second Mr. Johns' suggestion that it would be a great advantage if the members could have an opportunity of inspecting the plant. Did the figures given by the author cover the primary cost of the plant, such as condensers, exhausters, washers, holders, &c.?

Mr. Muir: No.

Mr. Canning (continuing) said that, of course, in the case of an undertaking supplying gas, some 50 p.ct. of the total capital would be sunk in mains and services. He saw that 264,000 gallons of benzole were mentioned among the products. Was this obtained by stripping the gas or from the tar, or both sources? Was it crude or refined benzole; and if it was not refined benzole, was it likely that 1s. a gallon would be secured for it?

Mr. Muir: It is refined benzole.

Mr. Canning: Then does the capital expenditure include provision of the necessary stills, &c.?

Mr. Muir: Yes.

Mr. Canning: I see no mention of ammonia in the products. What is done with that?

Mr. Muir: That is not included because at the present time it is a difficult market.

Mr. Canning appealed to the members to endeavour to preserve a perfectly open mind as to the respective merits of high-temperature, low-temperature, medium-temperature, or any other kind of carbonization. They were all of them liable to be a little prejudiced. They had a tendency to cling to high-temperature carbonization, and possibly they were right; but there was always the chance that they might not be. It seemed to him that success would depend first of all upon ability to get rid of the large quantity of fuel produced; while the greatest difficulty would be to induce the British public to discon-

tinue the use of coal, to which they were so closely wedded, and to adopt a different fuel. This trouble had been experienced in connection with gas coke. He assumed that "Ricoal" had a lower point of ignition than gas coke, and probably produced a cheerful fire; and he thought this would present the most important point in the success or otherwise of low-temperature carbonization.

Mr. W. COLLIN (Bridgend) seconded the vote of thanks, which was heartily accorded.

Mr. MUIR, in acknowledgment, said he greatly appreciated the kind remarks that had been made by the various speakers. Mr. Kenshole had mentioned that shareholders in low-temperature carbonization processes would be very glad to see a return on their money. With regard to the Illingworth system, the shareholders consisted of the five gentlemen who had sunk their money in the process. They had not so far gone to the public for money. Mr. Madden had raised a point with reference to the quality of the gas. With Yorkshire coal, it went up to about 900 B.Th.U. in low-temperature carbonization.

THE INFLUENCE OF TEMPERATURE ON THE FLAME VELOCITY OF GASES.

K. BUNTE and A. STEDING.

[An Investigation at the Karlsruhe Gas Institute of the German Gas Association. "Das Gas- und Wasserfach," July 14, 21, and 28, 1928.]

(*Concluded from p.* 651.)

FLAME VELOCITIES OF TECHNICAL GASES.

1. WATER GAS.

A suitable water gas for the test was produced by mixing together the various components, and it gave the following analysis:

50·5 p.ct.	H_2
47·0 ,,	CO
0·2 ,,	CO_2
1·9 ,,	N_2
0·4 ,,	O_2

The flame velocities are set out in Table VIII., up to 1000° C. in the furnace. The values for divided flame were the same as for ordinary flame, and are consequently not included. It will be seen that the velocity is increased by external heat, and principally between 800° and 900°. It was to be expected that the influence of the furnace temperature would not be so strong upon water gas as on pure hydrogen, as the flame velocity of carbon monoxide undergoes no change. The maximum of the velocity is not inclined in the direction of either gas or air excess in the gas mixture.

TABLE VIII.—*Water Gas in a Heated Zone.*

P.Ct. Gas.	V cm³/s.	20° Undivided Flame.		700°.		800°.		900°.		1000°.	
		h cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.
71·0	35·15	1·33	45·0	..	..	..	..	..	..	..	..
62·8	39·75	0·70	94·7	..	..	..	..	..	..	..	..
56·8	43·95	0·52	137·0	0·50	141·7	0·49	144·3	0·48	147·0	0·48	147·0
51·7	48·25	0·48	161·5	0·48	161·5	0·47	164·5	0·45	170·5	0·45	170·5
47·3	52·75	0·50	170·0	0·50	170·0	0·49	173·0	0·47	180·0	0·46	183·5
44·0	56·65	0·56	165·0	0·55	168·2	0·54	171·0	0·53	174·0	0·52	177·0
41·1	60·75	0·63	159·0	0·72	161·5	0·61	167·0	0·59	169·0	0·69	164·0
38·7	64·45	0·71	151·5	0·71	151·5	0·69	155·2	0·69	155·2	0·71	151·5
36·6	68·25	0·81	141·5	0·81	141·5	0·79	145·0	0·78	146·5	0·80	143·0
34·0	65·55	0·88	125·3	0·85	129·5	0·85	129·5	0·84	131·0	0 85	129·5
32·0	69·45	0·99	118·5	0·99	118·5	0·98	119·7	1·00	117·5	..	..
30·6	72·75	1·15	107·3	1·13	109·0	1·14	108·4	1·12	110·5	..	..
27·9	70·05	1·29	92·5	1·31	91·0	1·29	92·5	..	..	..	..
25·5	76·65	..	..	1·70	76·7	1·75	75·0	..	..	..	..
23·5	83·25	..	..	2·25	63·4	2·19	25·0	..	..	..	..
21·8	89·65	..	..	..	..	2·89	52·9	..	..	..	..

2. PRODUCER GAS.

By mixing the various components, a producer gas was made as follows:

29·1 p.ct.	CO
10·2 ,,	H_2
56·3 ,,	N_2
4·4 ,,	CO_2

The results obtained are given in Table IX. Here again the values for divided flame were the same as for ordinary flame, and so are not included in the table.

Producer gas, like methane, burned with a cone resting very uncertainly on the burner rim, which is to be explained by the high nitrogen content. As before, the distance from the apex of the cone to the burner rim was taken as the height of the cone.

As is seen from the table, the maximum of the flame velocity is only increased by some 2·8 p.ct., which is comparatively little. On the other hand, there is a noticeable inclination in the direction of excess air in the gas-air mixture. No doubt, however, inaccuracies in measurement were an influence in this case, as, of all the gases used, producer gas gave the least well defined cone.

3. HIGH-GRADE COAL GAS.

The coal gas used was taken at the beginning of a carbonizing period. It had a gross calorific value of 6240 cal. per cub.m. [690 B.Th.U. per c.ft.], and analyzed as follows:

TABLE IX.—*Producer Gas in a Heated Zone.*

P.Ct. Gas.	V cm³/s.	20° Undivided Flame.		600°.		700°.	
		h cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.
83·2	30·4	2·39	12·75	..	..	..	..
71·2	35·5	1·39	25·30	1·64	21·5	1·64	21·3
63·1	40·1	1·12	34·80	1·10	35·4	1·08	36·1
57·1	44·3	1·35	32·30	1·31	33·2	1·30	33·5
52·0	48·6	..	*	1·71	28·2	1·71	28·2
47·7	53·1	..	*	..	*	..	*
80·6	26·3	1·84	14·25	..	..	..	..
67·6	31·4	0·97	31·10	0·98	31·6	0·96	31·4
58·9	36·0	1·03	33·80	0·98	35·3	0·99	35·0
52·6	40·2	..	*	1·35	29·3	1·38	28·8
47·6	44·5	..	*	..	*	..	*
73·7	38·8	1·97	19·80	2·55	15·5	2·82	13·8
66·0	43·4	1·30	32·80	1·34	31·9	1·33	32·0
60·1	47·6	1·37	34·30	1·34	35·0	1·33	35·2
55·1	51·9	1·70	30·30	1·61	32·0	1·63	31·6
50·7	56·4	..	*	2·11	26·8	2·07	27·4
47·4	60·3	..	*	..	*	..	*
71·2	35·3	1·63	21·6	..	..	..	..
63·1	40·1	1·07	3·3	1·13	34·5	1·25	31·4
57·1	44·3	1·30	33·5	1·27	34·1	1·21	35·9
52·0	48·6	1·71	28·2	1·65	29·3	1·53	31·6
47·7	53·1	2·29	23·4	2·18	24·4	..	*
44·4	57·0	..	*	3·00	19·1	..	*
67·6	31·4	1·05	29·0	1·30	23·7	1·55	20·1
58·9	36·0	0·96	36·0	0·96	36·0	0·95	36·4
52·6	40·2	1·36	20·2	1·31	30·2	1·18	33·2
47·6	44·5	..	..	1·84	24·0	1·61	27·4
43·3	49·0	..	*	..	*	2·15	22·8
73·7	38·8	..	..	..	..	..	..
66·0	43·4	1·32	32·4	1·54	28·0	1·98	22·0
60·1	47·6	1·32	35·5	1·33	35·2	1·33	35·2
55·1	51·9	1·61	32·0	1·55	33·2	1·45	35·3
50·7	56·4	2·05	27·5	1·98	28·5	1·80	31·2
47·4	60·3	2·77	21·8	2·57	23·5	2·21	27·4
44·4	64·4	..	*	..	*	..	*

* Flame raised from burner.

2·9 p.ct.	CO_2
6·2 ,,	C_mH_n
1·3 ,,	O_2
10·4 ,,	CO
36·3 ,,	H_2
36·3 ,,	CH_4
6·6 ,,	N_2

No doubt for the same reasons as with methane, it was impossible with this gas to obtain stability of the cone with a divided flame. Values are given in Table X., and it will be seen that only a very slight increase of flame velocity is caused by external heating. There is, on the other hand, no displacement of the maximum of the culminating points of the curves.

KARLSRUHE TOWN GAS.

The available gas analyzed as:

3·7 p.ct.	CO_2
2·7 ,,	C_mH_n
0·6 ,,	O_2
7·1 ,,	CO
39·8 ,,	H_2
22·8 ,,	CH_4
23·3 ,,	N_2

The gross calorific value was 4700 cal. per cub.m. at N.T.P. [528 B.Th.U. per c.ft.]. With divided flame this gas also gave an unstable cone. Again no increase in flame velocity was observed under the influence of external heat, and no displacement of the maximum.

TABLE X.—*Coal Gas in a Heated Zone.*

Gas P.Ct.	V cm³/s.	20° Undivided Flame.		700°.		800°.		900°.		1000°.	
		h cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.
24·4	36·76	2·56	12·5	..	†	..	†	..	†	..	†
22·0	40·66	2·17	18·8	..	†	..	†	..	†	..	†
20·0	44·76	1·60	27·7	..	†	..	†	..	†	..	†
18·5	48·46	1·19	39·7	1·12	42·2	..	..	1·08	43·6	..	..
17·1	52·26	0·99	50·9	0·94	53·3	0·96	52·26	0·94	53·3	0·95	52·8
16·0	56·16	1·00	54·0	0·99	54·6	0·99	54·6	0·96	56·1	0·96	56·1
15·0	59·46	1·07	53·9	1·08	53·5	1·06	54·4	1·06	54·4	1·06	54·4
14·3	62·66	1·18	51·8	1·22	50·1	1·19	51·4	1·23	49·8	1·24	49·5
13·6	66·06	1·32	40·2	1·37	47·7	1·35	48·2	1·39	47·0	1·41	46·3
12·9	69·56	1·50	47·9	1·58	43·7	1·55	44·4	1·61	42·8	..	*
12·3	72·66	1·70	42·4	1·78	40·7	1·74	41·5	..	*	..	*
11·8	75·86	1·98	38·4	2·04	37·3	1·99	38·2	..	*	..	*
11·3	79·06	..	†	..	†	..	†	..	†	..	†
19·5	87·16	2·80	21·2	..	..	..	..	..	..	..	..
19·0	89·70	2·42	31·3	..	..	..	..	..	..	..	..
18·3	93·00	2·23	41·8	..	..	..	..	..	..	..	..
17·8	95·70	2·07	46·3	..	..	..	..	..	..	..	..
17·3	98·40	1·96	50·2	..	..	..	..	..	..	..	..
16·8	101·30	1·92	52·7	..	..	..	..	..	..	..	..
16·3	104·00	1·92	54·1	..	..	..	..	..	..	..	..
15·9	106·80	1·96	54·4	..	..	..	..	..	..	..	..
15·5	109·80	1·99	55·0	..	..	..	..	..	..	..	..
16·0	83·40	..	..	1·56	52·8	1·54	53·8	1·48	56·0	1·48	56·0
15·5	86·00	..	..	1·55	55·0	1·56	54·6	1·52	55·7	1·52	55·7
14·9	89·30	..	..	1·62	54·5	1·61	55·0	1·59	55·4	1·99	55·4
14·5	92·00	..	..	1·72	53·3	1·69	54·3	1·67	54·2	..	*
14·0	94·70	..	..	1·82	50·9	1·80	52·4	1·77	53·1	..	..
14·3	100·30	..	..	2·02	49·9	..	†	1·96	51·0	..	..

* Flame could no longer be read. † Cone flickered above the burner.

TABLE XI.—*Karlsruhe Town Gas in a Heated Zone.*

Gas P.Ct.	V cm³/s.	20° Undivided Flame.		700°.		900°.		1000°.	
		h cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.	*h* cm.	*u* cm/s.
28·7	55·4	2·66	20·9	..	..	..	..	..	..
26·9	59·2	2·15	27·5	..	..	..	..	..	..
25·2	63·1	1·64	38·2	..	..	..	..	..	..
24·0	66·4	1·37	47·8	..	..	..	..	..	..
22·8	69·6	1·25	84·6	1·32	51·0	1·29	52·9	1·29	52·9
21·8	73·0	1·22	58·4	2·24	57·6	1·24	57·6	1·22	58·4
20·8	76·5	1·28	58·5	1·27	58·8	1·28	58·5	1·28	58·5
20·0	79·6	1·34	58·4	1·34	58·4	1·35	58·0	1·39	56·4
19·2	82·8	1·46	56·3	1·44	57·0	1·47	55·9	1·47	55·9
18·5	86·0	1·59	53·6	1·67	54·2	1·59	53·6	1·62	52·6
17·3	91·9	1·87	49·2	1·83	50·0	1·91	48·1	..	..
16·3	97·3	2·24	43·8	2·20	44·2	2·25	43·3	..	..
15·4	102·9	2·70	38·3	2·84	36·2	..	..	..	..
14·6	108·7	..	..	..	..	..	..	..	..
25·1	47·8	1·30	36·2	..	..	..	..	..	..
23·3	51·5	0·98	50·6	..	..	..	..	..	..
21·7	55·3	0·91	58·1	0·90	58·6	0·91	58·1	0·91	58·1
20·3	59·2	0·97	58·6	0·96	59·2	0·97	58·6	0·97	58·6
19·3	62·5	1·07	56·6	1·06	57·2	1·02	56·6	1·09	55·6
18·3	65·7	1·23	52·2	1·19	53·8	1·22	52·5	1·27	50·6

SUMMARY OF THE RESULTS.

Whereas the work of Hofsäss and Dommer showed that a preheating of the gas-air mixture had a marked effect upon the flame velocity of all gases, the present series of tests proved that the temperature of the zone in which primary combustion takes place affects the velocity, and consequently the flame structure, in the case only of hydrogen. With no other plain gas was any effect traceable to the surrounding temperature. In the case of gas mixtures, the flame velocity is increased only when hydrogen is an important constituent of the mixture. Even then the increase is not in proportion to the quantity of hydrogen. It was quite marked, for instance, in water gas containing some 50 p.ct. of hydrogen, but in the case of a coal gas rich in hydrocarbons, and the town gas of Karlsruhe, which likewise contains 36 to 40 p.ct. of hydrogen, an increase in flame velocity was only slightly noticeable or entirely absent.

The raising of the flame velocity by preheating the gas-air mixture is doubtless due to the fact that the spreading of the combustion is dependent upon the heat consumption required to raise the mixture to ignition temperature. The fact that the temperature of the surrounding zone had no influence on the flame velocity of carbon monoxide and methane shows that with these gases there was no effective rise in the temperature of the gas-air mixture as it approached the inner cone. At the same time, no effect was observed of the reduced loss of heat, which there must be with the higher surrounding temperature, and which might be expected to give rise to an increase in the combustion temperature in the region of the cone in the direction of the theoretical combustion temperature.

The different behaviour of hydrogen is probably explained by its possessing some of the characteristics of metals, including a much higher heat conductivity than other gases. Its conductivity at 0° C. is given, according to two authorities, as 0·0003970 or 0·0004165; other gases varying between the 0·0003393 of CO_2 and 0·0007145 of methane. The heat conductivity of hydrogen is, therefore, roughly ten times as great as the average of other gases. That the increase in its flame velocity is reproduced in part only when in mixture with other gases can no doubt be partly explained by the stochiometrical proportions of the air requirement.

TABLE XII.

Gas.	Air Required.	H_2: Theoretical Gas-Air Mixture.	H_2 P.Ct. in Theoretical Gas-Air Mixture.
Hydrogen	2·38	1 : 3·38	29·6 p.ct.
Water gas	1·6653	1 : 5·28	19·0 ,,
Producer gas	0·9365	1 : 18·98	5·3 ,,
Coal gas—			
6240 cal.	5·8355	1 : 18·8	5·3 ,,
4700 ,,	3·8390	1 : 12·15	8·2 ,,

It is clearly seen that, in the theoretical gas-air mixture, the proportion of hydrogen in the case of water gas is much nearer the proportion with pure hydrogen than in the other three instances.

The highest flame velocity, however, is not attained with theoretical combustion mixtures, as has been seen in the tables. In Table XIII., the hydrogen contents are set-out which are found in the gas-air mixtures giving respectively the highest velocities.

TABLE XIII.

Gas.	P.Ct. Gas in Gas-Air Mixture which gives Maximum Flame Velocity.	P.Ct. H_2 in Gas-Air Mixture which gives Maximum Flame Velocity.	Increase P.Ct. in Flame Velocity at 900° C.
Hydrogen	43·5	43·5	15·0
Water gas	47·0	24·7	7·6
Producer gas	62·0	6·3	2·8
Coal gas—			
6240 cal.	15·5	5·6	1·8
4700 ,,	21·0	8·3	..

The percentages of hydrogen in the mixtures which show the highest flame velocities at 900° C. are plotted in the graph fig. 8. The points for hydrogen, water gas, and pure coal gas, it will be seen, all lie on one curve which, at 0 p.ct. water gas content, also passes through the zero point of increase of flame velocity. Within the limits of experimental error, the value for producer gas also lies on this curve. There is, however, no obvious explanation as to why the value for Karlsruhe town gas varied by some 3 p.ct. from what was to be expected.

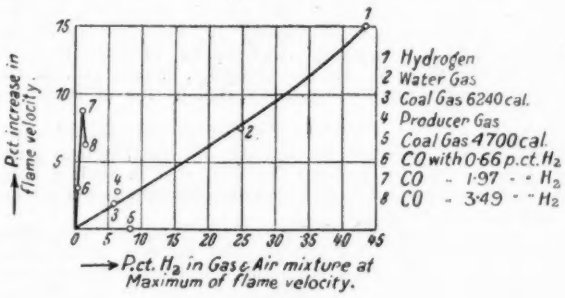


Fig. 8.

The effect of small admixtures of hydrogen to pure carbon monoxide is also an exception to this rule. At first they cause a considerable increase in flame velocity, as was shown under the heading of carbon monoxide, but the relative effect is moderated considerably even when the percentage of hydrogen reaches 3 p.ct. The action of the hydrogen seems to have analogy with the well-known effect of adding small quantities of water vapour to dry carbon monoxide, which, up to a certain point, increases the flame velocity even with combustion in a cool zone.

Good Year's Working at Lancaster.—The report of the Borough Treasurer for Lancaster (Mr. A. Bond) gives some interesting particulars relating to the Gas Department. The receipts from the sale of gas during the last financial year were £51,476—an increase of £3573—but residuals were less by £3638. The revenue account showed a decrease in expenditure of £17,237; coal and oil costing £17,673 less. The net profit was £7871, compared with a loss of £9573. The profit reduced the debit brought forward from the previous year to £1702. The expenditure out of the reserve fund was £1582, for a new scrubber washer; the fund now standing at £13,124. The loans on the capital account were increased by £5700, and £6250 was spent on extensions. The outstanding debt is £124,424, and the redemption fund stands at £40,070. Mr. G. Dixon is the Engineer and Manager.

World Power Conference.

Fuel Conference.

London, Sept. 24 to Oct. 6, 1928.

[For papers in the Carbonization Industries Sections, see "JOURNAL" for Sept. 26.]

Fuel Utilization.

General Report on Section J: Utilization of Fuel for Steam Generation and the Production of Electricity.

By G. STONEY.

[Extract.]

This general report covers the following papers, among others:

"*Researches with High-Pressure Steam*," by Dr. Jaroslav Havlicek.—An extensive research into the properties of steam up to 253 atm., or about 3600 lbs. per sq.in., at temperatures up to 500° C. (932° Fahr.). A most complete apparatus has been fitted up to enable tests of the greatest accuracy to be made. Comparison is made with the figures given by Mollier.

"*Economic Utilization of Fuel in the Production of Electricity*," by R. P. Sloan, C.B.E.—The total quantity of coal used for the generation of electricity in Great Britain is about 7·75 million tons per year, or 4·3 p.ct. of the total used in this country. This is not likely to increase much, for, though the use of current is rapidly going up, the economy of the power stations is increasing. Also supplies of waste heat are being further utilized. In one company, a reduction in the coal consumption of 21 p.ct. is effected by the utilization of such waste heat.

The cost of coal is relatively small in the case of small consumers such as small houses, and in typical figures given only amounts to 4·6 p.ct. of the total cost in such a case. On the other hand, for large consumers near the power station it may amount to 46 p.ct.

To produce electricity at the lowest cost, the proportion between capital and other charges and the cost of fuel must be such as to result in a minimum. Further economy must be sought by avoiding heat losses, pre-heating the air, bleeding or extracting steam from the turbine, re-heating, and higher steam pressures and temperatures.

In cases where process steam is required, large economies can be effected by the use of back-pressure turbines; any excess or defect in the electricity required being made up by feeding into, or taking current from, the supply company.

Another direction is in the treatment of coal to obtain the bye-products, and use of the resulting coke and gas under boilers. A complete account of the bye-product recovery plant at Dunston-on-the-Tyne is given. The value of the derivatives from 1 ton coal is 10s. 6d., and the value of the coke under the boilers 9s. 1d., or a total of 19s. 7d. On the other hand, the coal cost 12s., and the total cost of operation and maintenance 4s. 8d., or a total of 16s. 8d., giving a profit of 3s. 1d., so that up to the present no important commercial economies have been obtained; but these costs could be considerably reduced by working on a large scale.

"*Formulæ for the Economic Ratio of Blending Coals for Steam Raising*," by T. Sase.—On account of the interaction between one another of different kinds of coal when they are mixed, in some cases a higher evaporation can be obtained than with either coal separately, and thus important economies can be effected. The method of calculating the best mixture from tests is given.

"*The Principles of Flame Radiation*," by T. Lindmark.—The transmission of heat is by convection, gas radiation, and flame radiation, which latter is partly chemical radiation and partly radiation from minute particles of carbon. In the case of pulverized coal, the flame is increased by the fact that the particles increase in volume in burning, and that there remains a very porous and inflated core of coke. This increase in volume has been found to be as much as eight times in some cases. Recently work on the radiation of pulverized coal flames has been taken up by the Stockholm Technical University, and it is probable that their researches may have considerable effect on the design of radiation boilers.

"*The Duty of the Fuel Technologist and the Training of the Stoker*," by F. Smal.—Until recently the training of the stoker has been purely practical; but to get the best result, scientific guidance is necessary, which can be supplied by the fuel technologist, who, by tests, can determine the best thicknesses of the fire and the best draught to give the maximum economy at various loads. This guidance then enables the stoker to obtain the maximum efficiency.

Trend of Development.

The extraction of bye-products from the coal before burning is becoming of increasing importance on account of the extra use of tars, oils, and petrols, which in the future is likely to be greatly increased. Boilers are becoming larger and larger; and with the increase in the size of the grates, trouble is being encountered. At sea, mechanical stoking is making slow but sure progress. Air heaters are being more and more used, with considerable resulting economy; but this, again, causes trouble with the grates and also with the brickwork, due to the higher furnace temperatures. At the same time, pressures are rising, necessitating improved methods of manufacture. Steam temperatures are also rising, and are at present limited by the material for superheaters. If higher temperatures are to be utilized, some better material than mild steel—probably one of the alloy steels—must be used, at all events for the tubes exposed to the highest temperature.

As an alternative to burning the coal on a grate, pulverized fuel is being largely used, and will become of increasing importance in the future. Much more remains here to be done. The best methods of pulverizing and storing the coal have yet to be determined, and also how to deal with the very high flame temperatures, specially with pre-heated air, unless an excess of air is allowed, and consequent reduction in the CO_2 content of the flue gases. Pulverized coal may have a great future on board ship.

With the introduction of forced and induced draught, and also air heaters and economizers, the temperature of the flue gases has been reduced to a point where there is little tendency of the gases to rise when they leave the stack. At the same time, with induced and forced draught, high stacks are not necessary. Hence the pollution of the surrounding atmosphere is often serious. Again, with modern arrangements a considerable part of the ashes passes up the stack and is deposited on the surrounding country. The development of methods to prevent such nuisance will be necessary in the near future,

more especially as power stations are rapidly increasing in size.

Large economies can possibly be effected by the blending of coals, owing to what Mr. Sase calls the " digestive evaporation " of mixed coals; but this is a problem in which each case will have to be considered on its merits.

It is probable that the properties of high-pressure and high-temperature steam will be more accurately determined in the near future. Experiments by various methods are being carried out in several countries, and it is to be hoped that there will be full collaboration between various experimenters in each country to come to an agreement as to the most probable values of the properties of steam at high pressures and temperatures. Examination and comparison of the results obtained by different methods are of the utmost importance, as each experimental method is liable to systematic errors peculiar to that method, and each experimenter is apt to consider his own method the most perfect.

At present, there is no agreement as to steam tables to be used; and when the efficiency of a machine is being guaranteed, the steam tables employed have to be stated. There is room here for an International Commission, possibly on the lines of the International Electrotechnical Commission, if one has not already been formed.

AGENDA.

The discussion will be confined to: Prevention of nuisance from products of combustion, smoke, dust, and ashes; the advantages of coal distillation yielding bye-products before using the coal for the production of steam; the proportion between capital and other charges and the cost of fuel, so that the cost of electricity may be a minimum; advantages and disadvantages of various plants for pulverized fuel for use on land and sea; the best forms of mechanical stokers; limit of temperature and CO_2 in furnaces, and methods of increasing the temperatures possible; oil *versus* coal for generating steam and power; the relative advantages of various classes of coal for use in locomotives; methods of effecting economy in the coal consumption of locomotives; the relation between the properties of steam at high temperatures and pressures obtained by various experimenters in England, in the U.S.A., in Czechoslovakia, &c.

General Report on Section K: Utilization of Fuels, including Electricity, for Industrial Furnace Work.

By ROGER T. SMITH.

[Extract.]

This general report covers eighteen papers forming Section K. The papers, of which the following is a selection, may be grouped into three sections.

SECTION A: THE QUESTION OF SOLID, LIQUID, AND GASEOUS FUELS IN THEIR APPLICATION TO:

GENERAL INDUSTRIAL FURNACE WORK.

" The Hydraulic Theory of the Movement of Gases as Applied to the Construction of Furnaces " (Russia), by Prof. W. E. Groom-Grjimailo and Prof. M. Kirpitscheff.

" Industrial Heating by Solid, Liquid, and Gaseous Fuels " (Great Britain), by Sir Robert Hadfield, Bt., and R. J. Sargant.

FERROUS AND NON-FERROUS FURNACES.

" The Production and Utilization of Gas in German Iron and Steel Works " (Germany), by Dr. Bansen.

" Low-Grade Coal for Blast Furnace Coke " (Japan), by Dr. Tsurud Noda and Taizo Kuroda.

SECTION B: THE USE OF ELECTRICITY FOR INDUSTRIAL HEATING.

GENERAL APPLICATIONS.

" The Thermal Efficiency of an Industrial Electric Furnace " (Japan), by T. Kawasakiya.

" The Use of Electricity for the Production of Heat in Industrial and Manufacturing Installations " (Austria), by Dr. A. Velisek.

" Industrial Electric Heating " (Great Britain), by S. E. Monkhouse.

" Utilization of Electricity for Industrial Heating " (Canada), by A. T. Stuart.

" The Utilization of Electricity for Industrial Heating " (U.S.A.). Presented by the American Technical Committee.

SECTION C: PRODUCTION AND USE OF GAS.

GENERAL APPLICATIONS.

" Industrial Gas in the United States—Growth and Trend " (U.S.A.), by the American Gas Association.

SOLID, LIQUID, AND GASEOUS FUELS FOR INDUSTRIAL FURNACE WORK.

" The Hydraulic Theory of the Movement of Gases as Applied to the Construction of Furnaces " is described in three parts submitted by the Russian National Committee. The third part of the paper defines the hydraulic theory of the movement of gases. The flame movement is considered to be that of a light fluid inside a heavy fluid. Experiments are described showing the movement of hot gases round heated pipes and heated plates. The loss of heat in a free stream of hot gases is treated quantitatively.

The " Industrial Heating by Solid, Liquid, and Gaseous Fuels " is treated in a paper presented by the Technical Committee, Fuel Conference. Perhaps the most interesting section of this comprehensive paper is that dealing with solid fuel. Mechanical stokers, owing to their high first cost, have not been largely used for intermittent furnaces, but to-day heat-resisting steel can be made which can stand more than 1000° C. without oxidation and maintain sufficient strength. Recently such heat-resisting steel has been made with a definite resistance to the action of sulphur at such a temperature. One important application of heat-resisting steel is its use in recuperators for saving furnace heat. Experience with the pre-heating of air by steel tube recuperators in place of the large refractory recuperators formerly used shows great improvement. The limitation to the amount of pre-heating of primary air by recuperation is the excessive formation of clinker.

The first part of the paper deals with the relative advantages of solid, liquid, and gaseous fuels, chiefly in reference to their adaptability factor. This adaptability factor includes site occupation by furnace and by fuel storage, fuel supply, suitability for intermittent work, and labour required. In Great Britain solid fuel is cheaper than liquid fuel (of which powdered fuel is considered as a class) or gaseous fuel, but the greater adaptability of the latter two may often outweigh their higher cost as compared with coal.

" The Production and Utilization of Gas in German Iron and Steel Works " is dealt with by the Verein deutscher Eisenhuttenleute. This paper is devoted to the possibilities of using blast furnace gas made in an iron and steel works producing basic pig iron in all the processes connected with the works, including generation of electricity, though the author considers that coal is best used for electricity generation and for rolling mills. The works must, of course, be designed to produce equilibrium between gas supply and gas consumption, including the transmission of gas to other industrial users, or its sale for electricity supply generation.

For the production of power from gas, the steam turbine burning the gas in a special or marine type tubular boiler is preferred to the gas engine; boiler efficiencies of from 80 to 83 p.ct. being claimed in small boilers, and 80 to 86 p.ct. in a special boiler working at 35 atmospheres steam pressure and at 400° C. steam temperature, supplied with air preheated to 400° C. and no economizers. The waste-heat boiler is condemned as comparatively uneconomical. Describing the use of the gas in various furnaces, the author advocates coke ovens heated by purified blast furnace gas at constant pressure. The whole of the coke oven gas should be used in the steel works and rolling mills. Open hearth furnaces should be heated by a preheated mixture of blast furnace and coke oven gas.

USE OF ELECTRICITY FOR INDUSTRIAL HEATING.

" The Thermal Efficiency of an Industrial Electric Furnace " is discussed by the Power Association of Japan. The author divides the efficiency of an electric furnace, in which the heat given to the furnace electrically can be accurately measured, into two parts. First, the thermo-dynamic efficiency, and, secondly, the relative contribution efficiency. The author gives definitions of these factors, and says the product of these two quantities is the thermal efficiency of a furnace. It would seem that the efficiency used in the paper by Sir Robert Hadfield, and quoted by the author of the present paper from a work by M. D. K. Thomson—namely, the ratio of heat actually used to heat the reacting substances to the required temperature *plus* the heat absorbed by the reaction to the total heat supplied—will remain in use until it can be bettered.

In the paper " The Use of Electricity for the Production of Heat in Industrial and Manufacturing Installations," presented by the Austrian National Committee, it is stated that in Austria there has been a steady growth in the use of water-power generated electricity for heating water, steam raising, mould drying, rivet heating, welding, smelting, and reverberatory

furnaces. Other uses are being explored. The effect of a night load for heating purposes on electric generating stations has greatly improved the twenty-four hour load curve; and the paper tabulates the additional loads on power stations due to the use of electricity for heating.

"Industrial Electric Heating" is discussed in a paper presented by the British Electrical Development Association. Many of the uses in Great Britain, where electricity is mostly generated from coal, of electric heating and industrial electric furnaces are given. The general experience is that, though the cost of the actual heating is greater than with solid fuel, the results are so satisfactory that the use of electricity in Great Britain is extending. This applies especially to heat-treatment and tempering processes.

In a paper on the "Utilization of Electricity for Industrial Heating," presented by the Canadian National Committee, the author develops the view that, since the fundamental constituents of fuel are hydrogen, oxygen, and carbon, and that combustion in a hydrocarbon fuel is hampered by the 80 p.ct. of nitrogen in the air, pure oxygen for the enrichment of air will be made in the future by the electrolysis of water. Water rather than air is chosen, because of the liberation of the oxygen and hydrogen in complete separation, and the value of the latter as fuel. The author shows the advantage to electric supply of filling up the seasonal valleys of the electricity load curve by such an electrolytic load; and provided the oxygen and hydrogen are cheap enough—*i.e.*, if the electricity is cheap enough—he predicts the use of fluid fuels (which includes gas). The author considers that cheap oxygen and hydrogen having many industrial uses can be obtained for 5 cents, or one halfpenny per 1000 c.ft., by the use of peak hydro-electric current.

"The Utilization of Electricity for Industrial Heating" is discussed by the American Committee. It is estimated that in the U.S.A. some 2 million KW. of electricity is being used for industrial heating, representing a little more than 10 p.ct. of the electric motor load.

Industrial Gas.

The paper "Industrial Gas in the United States—Growth and Trend," presented by the American Gas Association, is an outstanding contribution, and contains a most valuable survey of the industrial use of gas in the United States. The publication of the illustrated appendix to this paper has been made possible by special financial arrangements with the American Gas Association. In this paper it is shown that the use of industrial gas has increased by 93 p.ct. in eight years. The development of modern heat-treating practice is shown by photographs and data.

Agenda.

Among other matters, the following will be discussed: The importance of air—or air and gas—preheating, and the use of heat-resisting steel for recuperative apparatus; the use of gaseous fuel based on the employment of blast furnace gas, whether enriched or not with coke oven gas, for all the heating processes in steel works; the use of gaseous fuel for all industrial purposes; the advantages of adaptability and control of electric heating, where heating by electricity costs more than direct heating by fuel; and conditions under which heating by electricity is cheaper than direct heating by fuel, as in firing pottery, or where either thermic electric generating stations or water power stations can give specially cheap rates for electricity bought off the peak load.

General Report on Section L: Utilization of Fuels, including Electricity, for Domestic Purposes.

By Dr. MARGARET FISHENDEN.

This general report covers the nine papers comprising Section L—namely:

- "The Use of Electricity for the Production of Heat in Houses, Offices, and Business Premises" (Austria). Authoritative Body: Austrian National Committee, World Power Conference. Author, Dr. A. Velisek.
- "The Use of Gas for Domestic and Industrial Purposes in Vienna" (Austria). Authoritative Body: Austrian National Committee, World Power Conference. Author, H. Günter.
- "Utilization of Solid Fuels for Domestic Purposes in Czechoslovakia" (Czechoslovakia). Authoritative Body: Czechoslovakian National Committee, World Power Conference. Author, E. Dvorák.
- "Some Considerations regarding the Development of Gas-Burning Appliances" (Germany). Authoritative Body: Deutscher Verein von Gas- und Wasserfachmännern. Author, Dr. Ludwig.
- "A Comparative Study of Solid Fuel, Gas, Electricity, and Oil for Domestic Purposes" (Great Britain). Authoritative Body: Technical Committee, Fuel Conference. Author, Dr. Margaret Fishenden.
- "Electric Heating for Domestic Purposes in Japan" (Japan). Authoritative Body: Power Association of Japan. Author, Viscount Shimpei Goto.
- "Fuel for Domestic Purposes in Sweden" (Sweden). Authoritative Body: Swedish National Committee, World Power Conference. Author, Axel Härlin.
- "Electric Hotplates for Domestic Cooking" (Sweden). Authoritative Body: Swedish National Committee, World Power Conference. Authors, N. Ekwall and O. Stalhane.
- "Domestic Heating by means of Solid Fuel, Oil, Gas, and Electricity" (U.S.A.). Authoritative Body: U.S. Bureau of Mines.

Summary of Points of Outstanding Interest.

At the present time, about 15 p.ct. of the total coal mined throughout the world, or in the aggregate some 180 million English tons annually, is consumed in its raw state for domestic purposes. The principal object of Section L is to discuss the extent to which this household coal could be replaced efficiently and economically by other sources of energy, which must of necessity themselves be derived in the main from natural carbonaceous deposits. The most important of such are the products from the carbonization or distillation of coal—particularly coal gas and gas coke—and electricity generated from coal. It is estimated that the world consumption in each of these industries is about 5 p.ct. of the total for all purposes.

Locally, of course, other possibilities present themselves. In Sweden, for instance, wood is the principal fuel, since the working of indigenous peat is expensive, and coal has to be imported; consequently the utilization of wood waste is receiving attention. In other countries water power can be exploited successfully. Thus in Japan 3,580,000 H.P. water power, or about 25 p.ct. of the total the rivers are estimated to be capable of producing, and equivalent to the energy annually from about 15 million tons of coal, was being used for power generation at the end of 1926. In the western parts of the U.S., low-priced power from hydro-electric developments is also largely employed, especially as the cost of fuels is relatively high.

In up-to-date gas manufacture, saleable coke represents about 45 p.ct., saleable gas 25 p.ct., of the thermal value of the coal carbonized. In large modern stations the thermal efficiency of the generation of electricity from coal is about 20 p.ct. In general, the cost of manufactured gas on a thermal basis is much higher than that of coal; the cost of electricity much higher than that of gas. On the other hand, electrical appliances usually give relatively high efficiencies in use, solid fuel appliances relatively low efficiencies.

The success with which prepared fuels or electricity can compete with raw coal depends as much upon the manner of their use as upon their inherent characteristics. Thus insulation of the building fabric reduced the heat requirements of a house by nearly 40 p.ct. Again, the admission of additional air to the fire space of a stove burning brown coal increased the efficiency from 57 to 73 p.ct.; while the efficiency of heating water on an electrical hotplate was reduced from 63 p.ct. to 5 p.ct. by battering the vessel, or from 75 p.ct. to 47 p.ct. by increasing the distance between hotplate and vessel from 0 to 0.5 mm.

There is thus generally considerable uncertainty in deciding upon the the relative efficiencies which should be assigned to different fuels, except in specified circumstances. The papers submitted are united in indicating the difficulties of generalization in the domestic field, where the requirements not only vary from place to place and from family to family, but, even considered individually, are compounded of a number of diverse and varying items, particularly the warming of dwellings, the production of hot water, and the cooking of food. Hence developments may be expected to proceed along very different lines in different countries or in different districts.

For instance, though preferential tariffs for storage heating during off-peak periods are being offered by many electricity undertakings, the circumstances in certain districts in the United States, where the principal load (irrigation) occurs during the hot months, allow of cheap rates even for direct heating.

Many gas companies are also offering preferential rates for house heating; and in the United States central house heating by gas is stated to promise the largest future domestic market.

being specially attractive in localities where the heating season is extended, but where the extreme temperatures reached are not very low. On the other hand, the effect of the general adoption of gas heating in a district would be to increase capital costs, since the demand on very cold days would be so much above the average. For this reason the Vienna gas undertaking avoids pushing the use of gas for the heating of buildings, but encourages it for cooking and hot water production.

In spite of the diversity of the domestic field, certain broad general conclusions can be arrived at. The following are the mean estimated working efficiencies for various types of heating appliances:

	Efficiency.
Central Heating—	
Coal	50 p.ct. (to water or steam)
Coke	50 ,, ,, ,,
Oil	60 ,, ,, ,,
Gas	75 ,, ,, ,,
Electricity	95 ,, ,, ,,
Stoves with Flues—	
Coal	50 p.ct. (radiation and convection)
Coke	55 ,, ,, ,,
Anthracite	60 ,, ,, ,,
Gas	75 ,, ,, ,,
Flueless Stoves—	
Oil	100 p.ct. (radiation and convection)
Gas	100 ,, ,, ,,
Electricity	100 ,, ,, ,,
Open Fires—	
Coal	20 p.ct. radiation
Coke	25 ,, ,,
Gas	45 ,, ,,
Electricity	75 ,, ,,

An interesting series of experiments carried out last winter in Vienna showed that for room heating 39 KW.-hour per cub.m. was required during the heating season in an electric hot-water storage system, 30·5 KW.-hour in an electric storage heater, and 25 KW.-hour in a direct electric heater, in comparison with 8·9 cub.m. of gas. This would mean that with electricity at 1d. a unit electric heating would cost respectively 2·5, 1·9, or 1·6 times as much as 500 B.Th.U. gas at 10d. a therm. Elsewhere it is estimated that at these prices direct electric heating costs 1·3 to 1·7 times as much as gas fires; electric stoves 2·8 times as much as flueless gas stoves or 2·2 times as much as gas stoves under flues—figures in reasonable agreement with the Austrian ones.

For the continuous warming of rooms, however, whether by central installations or by individual stoves or fires, or for the heating of water, because its initial cost on a thermal basis is relatively so low, solid fuel is usually much cheaper than gas, gas much cheaper than electricity. For intermittent heating, on the other hand, the position of solid fuel may be reversed; and even in centralized systems the flexibility and automatic control possible with gas or electricity tend to reduce the discrepancies in running costs.

For cooking purposes gas or electricity at normal prices costs little or no more in up-to-date appliances than solid fuel; and gas is very largely used for cooking in modern urban districts.

It does not follow that the fuel which costs the consumer least for any purpose will entail a minimum initial coal consumption. As has already been stated, the thermal efficiency of the production of gas from coal is 50 p.ct., that of the generation of electricity at the best 20 p.ct. On this basis, provided that gas appliances are not less than twice, electrical appliances not less than five times, as efficient as their coal-fired counterparts, no waste of a country's coal reserves would be involved through their adoption. It will be seen from the table above that, for equal heat production, gas in open fires can comply with this condition; for intermittent use its position is better still. When used in stoves or central systems, though the efficiency is only 1½ times that of solid fuel, the lessened output allowed by greater flexibility and superior control may still prevent any increase in effective coal consumption as compared with the direct use of raw coal.

Where solid fuel must for reasons of economy be retained, considerable attention is being paid to obtaining more complete combustion with reduced smoke emission and increased thermal efficiency, or to the possibility of the substitution of coke for raw coal.

Indication of Trend of Development.

Perhaps the most outstanding development in the field of domestic fuel utilization is the ever-growing realization in all countries of the necessity for substituting methods based upon sound scientific principles for the wasteful appliances still in many cases existent, alike in the interests of fuel conservation, economy to the consumer, and smoke prevention.

The main trend of progress is in the direction of subjecting an increasing proportion of raw coal to some preliminary process whereby either it may be rendered smokeless, or the bye-products may be recovered, or both (*i.e.*, carbonization and electricity generation). The possibilities of utilizing increased water-power are also being explored.

Methods of charging are engaging widespread attention in the electrical industry; and efforts are being made, by the introduction of preferential rates for storage heating during specified hours, to increase output in such a way as to improve load-factors.

Higher efficiencies are being sought in solid fuel installations, and there is a tendency to replace raw coal by coke; while, locally, attempts are being made to utilize various low grade fuels.

Summarizing:

(1) Heating.
- (*a*) Central heating is becoming more general. Most often solid fuel is used, but oil, gas, or even electricity is being increasingly adopted.
- (*b*) Gas fires, and to a lesser extent, electric heaters, are replacing open coal fires or stoves for intermittent heating and are also being used extensively in conjunction with central heating.
- (*c*) Improved designs of solid fuel appliances are being introduced, and coke is being substituted for raw coal.

(2) Cooking.
- (*a*) The use of gas, and to a lesser degree of electricity, is rapidly increasing, especially in towns, and promises practically to supplant the solid fuel range.

(3) Water Heating.
- (*a*) Gas is being increasingly used for water heating, especially where either the demand is intermittent or automatic action is of importance.
- (*b*) Independent coke-fired boilers for hot water supply are being largely used in conjunction with gas for cooking.
- (*c*) Electrical water heating is being pushed; the necessary current sometimes being taken at reduced rates during off-peak hours.

Agenda.

The discussion is to be confined to the various methods of warming rooms or buildings, cooking food, and heating water. In particular: Gas, electricity, and oil in relation to solid fuel (*a*) for heating, (*b*) for cooking, (*c*) for hot water production; central heating *versus* individual grates or stoves; kitchen installations; the combustion of domestic fuels; conditions of maximum efficiency in domestic heat production; methods of charging for gas and electricity; and coke *versus* raw coal.

A Comparative Study of Solid Fuel, Gas, Electricity, and Oil for Domestic Purposes.

By Dr. MARGARET FISHENDEN.

During recent years the prices of fuels have fluctuated widely; they are also subject to considerable local variations. It is thus somewhat difficult to decide which averages should be selected as representative of normal conditions. For the present comparisons, however, the following prices have been adopted:

Bituminous coal (13,500 B.Th.U. per lb.)	45s. per ton
Anthracite (14,500 B.Th.U. per lb.)	75s. ,, ,,
Gas coke (12,500 B.Th.U. per lb.)	40s. ,, ,,
Fuel oil (19,000 B.Th.U. per lb.)	95s. ,, ,,
Paraffin oil (19,500 B.Th.U. per lb.)	1s. ,, gallon
Gas	10d. ,, therm (100,000 B.Th.U.)
Electricity	1d. per unit (3410 B.Th.U.)

On this basis the relative costs of potential heat units in the different fuels, referred to bituminous coal as unity, are as follows:

Bituminous coal	1·0
Anthracite	1·6
Gas coke	1·0
Fuel oil	1·5
Paraffin oil	4·3
Gas	5·6
Electricity	16·1

Gas coke, provided it does not contain too much moisture and ash, gives a higher radiation efficiency and a more uniform heating effect than raw coal in open grates; but it is somewhat difficult to light, and does not burn well unless the draught through the fire is high, the firebed deep, or the in-

sulation of the grate effective. For this reason, a number of grates designed specially for use with coke have recently made their appearance. Attention is also being paid to the possibility of developing upon a sound commercial basis processes of low-temperature carbonization, for the production of a free burning solid smokeless fuel. This low-temperature coke is, of course, like gas coke, subject to variations in quality, according to the nature of the coal from which it is made, and the method of quenching; but both its structure and increased proportion of volatiles render it relatively easy to ignite.

The writer found that a gas coke of calorific value 12,900 B.Th.U. gave, when nearly dry, radiation efficiencies of 24 p.ct. and 28·5 p.ct. respectively in two different types of ordinary commercial grates, compared with 21 p.ct. and 24·5 p.ct. for a good house coal. Coke containing 15 p.ct. or 20 p.ct. of moisture, however, was no better than coal. Again, various samples of low-temperature cokes burning in different grates emitted radiation equivalent to 20 p.ct. to 34 p.ct. of their thermal value, as against 17½ p.ct. to 24½ p.ct. for coal.

The disposal of ash without too far disturbing the fire and thus chilling the fuel is, in many cases, a serious consideration in coke fires. Further, Bligh and Hodsman have shown recently that the radiation efficiency of coke is closely associated with its ash content. Thus two cokes, both nearly dry, but containing 5½ p.ct. and 1½ p.ct. of ash respectively, gave radiation efficiencies of 25 p.ct. and 29 p.ct., as compared with 20 p.ct. for coal fires in the same grate. By treating coke with sodium carbonate its ignitibility and combustibility were greatly increased, though the radiation efficiency was slightly decreased.

Very high proportions of radiation can be obtained from high-temperature electric heaters. The over-all efficiency of such heaters is, of course, nearly 100 p.ct., radiation frequently reaching 70 p.ct. or 80 p.ct. The balance is available in direct air heating, unless the heater is situated under an open flue, when it is lost as a heating agent but becomes effective in promoting ventilation.

Central Heating Systems.

The efficiency of low-pressure cast-iron boilers, such as are generally used in central heating installations, varies widely with their design, size, and manipulation, as well as with the fuel used. Very small domestic boilers, such as are employed for supplying hot water to taps or for maintaining a limited number of radiators, give relatively low efficiencies—say, 30 to 40 p.ct. with bituminous coal, and 35 to 50 p.ct. with coke or anthracite.

The U.S. Bureau of Mines, in tests of small steam boilers suitable for warming a seven to eight-roomed house, obtained efficiencies of 70 p.ct. with either 11,500 B.Th.U. bye-product coke containing some 4 p.ct. of moisture and 15 p.ct. of ash, or with 11,900 B.Th.U. anthracite containing about the same proportions of moisture and ash. High-volatile Pittsburgh coal, on the other hand, though considerably lower in moisture and ash, and of a calorific value of over 13,000 B.Th.U., gave only 54 to 62 p.ct. efficiency.

In similar tests of boilers adapted to heat large buildings, with the furnace conditions so regulated as to obtain minimum losses and produce as little smoke as possible, efficiencies varying from 66 to 79 p.ct. were obtained from coke, 66 to 77 p.ct. from anthracite, 66 to 72 p.ct. from medium volatile coals, and 65 to 74 p.ct. from high-volatile coals. A half-and-half mixture of coke breeze and coal gave efficiencies from 57 to 65 p.ct. The average efficiencies for coke, anthracite, and bituminous coal were about equal. At low rates of combustion coke and anthracite, which could be burned with relatively low excess air, are better than coal, but at high rates coal is better than coke or anthracite.

Similar values have been obtained at the Canadian Department of Mines Fuel Testing Station in tests of a small hot-water heater designed to warm a house of eight or nine rooms; the heat imparted to the water varying from 67 to 76 p.ct. with coke, 67 to 77 p.ct. with anthracite, 63 to 67½ p.ct. with semi-bituminous coal, and 57½ to 67 p.ct. with high-volatile coal.

Tests of heating installations described in the Thirteenth Report of the Commission Interministerielle d'Utilisation de Combustible showed that for equal results 15 to 25 p.ct. more coke than anthracite by weight was required; but taking into account its lower calorific value, coke gave a slightly higher thermal efficiency than anthracite.

The good results obtained by Nicol and others on coke-fired boilers in this country are well known, efficiencies as high as 83 to 89 p.ct. being quoted for a boiler and economizer installed to meet the requirements of a London hospital.

Interesting information has recently become available in regard to the close relation between the sizing of cokes and their behaviour in boiler work. In tests made by the Comité Central des Cokes de France, 45 mm. coke gave 83 p.ct. efficiency, in comparison with only 77 p.ct. for 20/35 mm. size; the reduction being due to increased formation of carbon monoxide. Similar results were obtained at the Stockholm Gas-Works; 65/100 mm. and 15/25 mm. coke giving in parallel tests efficiencies of 80 p.ct. and 62 p.ct. respectively, the loss in unburned products of combustion rising from less than 3 p.ct. with the larger fuel to 21 p.ct. with the smaller. Practically no difference was found between gas coke and metallurgical coke.

In practice, however, boiler performances fall far short of those shown in test runs, and Haslam has stated that the average efficiency attained from solid fuel in house heating installations in the United States probably does not exceed 50 p.ct.

Of all fuels, gas gives the highest all-round efficiency in small-scale boiler work; 75 p.ct. probably representing a fair mean, and 85 p.ct. or more being reached in special cases. Further, it allows of easy and rapid regulation, with automatic control, and does away with the necessity of fuel storage.

Hot-water radiators of the ordinary type convect their heat mainly to the air, radiation being checked by the screening action of adjacent columns upon one another, while air can circulate over the entire surface. Long radiators thus emit relatively less radiation than short ones; double-column radiators less than single-column. Thus Allen found that single-column cast-iron radiators at 215° Fahr. gave 50 p.ct. convection, 42 p.ct. radiation; four-column ones 70 p.ct. convection and 30 p.ct. radiation.

Solid Fuel Ranges.

Under the best conditions, solid fuel ranges with back boilers, whether of old-fashioned or of modern design, give water efficiencies varying from 10 to 20 p.ct. When the oven is in use, or the hot water damper in, these values may fall to 5 or 10 p.ct.

The hotplate, if fully loaded, may communicate as much as 10 or 20 p.ct. of the heat of the fuel burned to utensils on it; but in practice, efficiencies exceeding 10 p.ct. are seldom attained, and the average efficiency over a whole day would never approach even this latter figure. Theis, for instance, found that three ordinary pans of water on the hotplate of a continental range absorbed 18 p.ct. of the heat of the coal burned. Barker obtained corresponding values ranging from 2½ p.ct. to 13 p.ct. for hotplates covered with pans of water, and 1 p.ct. for an open range loaded to its full capacity.

The heat communicated to the food in the oven of solid fuel ranges for moderate loading varies up to about 5 or 6 p.ct. Marsden, for instance, obtained a value of 4·7 p.ct. for an oven used at practically its maximum capacity, while Barker's results for either an open Yorkshire or closed cottage range were about 5 p.ct.

Independent boilers, where the fire is more or less completely surrounded by the boiler surfaces, give water-heating efficiencies of 40 to 50 p.ct. with moderately dry coke, or 30 to 45 p.ct. with bituminous coal. Among the most interesting recent developments are the modified designs of such boilers in which a flat top provides limited hotplate accommodation, while doors at the front of the fire allow of a small area of incandescent fuel being exposed when a radiating surface is required for reasons of warmth. One or two hot water radiators, in addition to the domestic hot water supply, may be maintained from such appliances, and in some designs an oven is included. Many of them are of a neat and simple appearance, which allows of their introduction into the kitchen or living room, and the small sizes can be maintained on a very low fuel consumption; coke being more convenient than coal. For high over-all efficiency no other ranges on the market are to be compared with them.

Gas and Electric Cookers.

Gas or electric cookers are far more efficient than coal-fired ranges. The heat utilized in the oven varies over wide limits according to the conditions of use and the construction of the cooker, but fair averages for well loaded ovens of good design appear to be about 35 p.ct. for gas, and 70 p.ct. for electricity. Barker obtained 26 to 38 p.ct. for gas ovens, while Marsden gives corresponding values of 17 to 39 p.ct., and 66 to 79 p.ct. for an electric oven.

For hotplate work, thermal efficiencies from 40 to 55 p.ct. can be obtained from the better types of commercial gas rings.

The results of numerous tests of electric hotplates show efficiencies usually varying from about 30 to 60 p.ct. Generally speaking, the radiant or open type is more suitable for intermittent work than the closed type, on account of its lower heat capacity; but closed hotplates may give high efficiencies in continuous use. Self-contained vessels, in which there are practically no heat losses other than those from exterior surfaces, give efficiencies of 90 p.ct. or more for boiling purposes.

For domestic hot water supply, efficiencies of 75 p.ct. can be obtained from gas circulators or 80 p.ct. from geysers, while electric immersion heaters give nearly 100 p.ct. efficiency.

Cost of Heating.

Taking the mean radiation efficiency of modern gas fires as 45 p.ct.; of open fires burning under normal conditions as 20 p.ct. for bituminous coal, 25 p.ct. for coke; and of high-temperature electric radiators as 75 p.ct.; the comparative fuel costs for equivalent radiation emission become coal 1, coke 0·8, gas 2·5, electricity 4·3. Solid fuels, and especially coke, are thus much cheaper than gas and gas much cheaper than electricity. The superiority of coke in this respect may not be maintained in poor qualities, especially those retaining high

proportions of water after quenching, which not only reduces their thermal value but makes them more difficult to light and decreases the radiation efficiency obtainable.

Costs of Hot Water Production.

Hot water requirements on the large scale can be easily and cheaply provided for either by separate boilers or by calorifiers run in conjunction with a central heating plant. Small independent boilers are also available for domestic hot water supply, and may or may not be connected up to a limited number of radiators. Coke at 40s. a ton in such appliances for equal hot water production costs about one-third as much as gas at 10d. a therm used in circulators or geysers, or about one-seventh as much as electricity at 1d. a unit in immersion heaters. The effective coal consumption involved is much the same whether solid fuel is burned directly or is first converted into gas; but it is trebled by the use of electricity. Even the ordinary back boilers of kitchen ranges, though their capacity is somewhat limited, can maintain a continuous supply of hot water at about the same cost as gas; but the effective fuel consumption is in this case reduced to one-half by the use of gas. Electricity costs more than twice as much as range boilers heated by solid fuel, but involves only about the same initial fuel consumption.

Notwithstanding its higher running cost for continuous supply, there are many instances in which, all things considered, gas for water heating, particularly where the demand is intermittent, may prove more economical than solid fuel, since storage losses are thereby eliminated and the necessity for attendance avoided. Hence gas is suitable for supplying the taps in cloakrooms, &c., or as a substitute for back boilers in summer. Electricity at 1d. a unit is too expensive for water heating except in special cases, or for "topping up" a water supply warmed by other methods; but at less than ½d. a unit it is comparable in cost with gas.

Costs of Cooking.

It is not possible to arrive at the exact relative costs of cooking by alternative methods, even if the water heating and room warming capacity of solid fuel ranges is left out of the question, for the comparison depends upon both the nature of the meal to be prepared and the relative extent to which oven and hotplate are used. On the basis of thermal consumptions in the ratio of 1 : 0·5 : 0·08 for coal, gas, and electricity respectively, however, as determined by practical cooking experiments, the costs of the three methods are all about the same. Thus coal would be saved by the substitution of either gas or electricity for the solid fuel range. This probably expresses the truth fairly closely for the cooking of meals where both oven and hotplate are in use. For hotplate work alone, gas would be cheaper than either coal or electricity.

Probable Future Developments.

The general trend in domestic heat production in this country is the partial substitution of gas for coal, and the replacement of coal by coke where a solid fuel must, for reasons of economy, be retained. The most pronounced developments during recent years have been:

(*a*) The use of gas (and to a much smaller degree, of electricity) for cooking.
(*b*) The use of gas (and to a much smaller degree, of electricity) for intermittent heating.
(*c*) The use of coke-fired boilers for hot water production.
(*d*) The use of gas for intermittent water heating.
(*e*) The central heating of large houses or large buildings, either alone or in conjunction with open fires.
(*f*) The replacement of old-fashioned kitcheners by smaller, better controlled, ranges.
(*g*) The provision of better draught control in sitting-room grates.

Sir Dugald Clerk, in 1919, gave as the probable division of coal gas in the United Kingdom, heat 55 p.ct., light 35 p.ct., motive power 10 p.ct. Further, it has been computed from recent Board of Trade returns that as much as one-third of the total receipts for town gas is derived from prepayment meters alone, in small houses, hotel bedrooms, &c. It may thus reasonably be inferred that at least half the gas sold is used for domestic heating and cooking purposes—that is, a quantity involving the carbonization annually of 9 million tons of coal, or representing a net consumption of 4 million tons after allowing for coke and tar. No accurate figures are available to show the distribution of the coke, but probably about one-third of it, or 2 million tons annually, is used for non-industrial purposes, including the warming of churches, schools, factories, offices, &c.

Of the electricity sold in 1926, only about 22 p.ct., or an amount involving the combustion of about 2 million tons of coal, was used for domestic purposes, including lighting; and though the rate of development in this field is relatively high, it may be concluded that, as yet, electricity finds only a very restricted outlet for cooking and heating purposes. This is a natural position, for at the present low efficiencies of generation the use of electricity for heat production, notwithstanding the relatively high efficiency of the appliances in which it is used, practically always entails a relatively high expenditure both to the consumer and in initial coal consumption.

The immediate future will no doubt see continued development in the substitution of gas and coke for bituminous coal in domestic appliances; and the building-up of a steady market for coke should react favourably upon the price of gas. Such changes practically always result in a reduction in the initial coal consumption required for any specific purpose.

A Brief History of the Gas Industry in Japan.

By SAKURA OKAMOTO.

Authoritative Body: Power Association of Japan.

DEVELOPMENT OF THE GAS INDUSTRY IN JAPAN.

The Preliminary Stage.

The gas industry was introduced to Japan when the German Consul Von Adolph Reis attempted to get a franchise from the Yokohama City Authorities in 1870. His original plan, endorsed and supported by the Belgian Minister, was to erect lamp-posts along the streets, which were to be illuminated by coal gas by a private concern. Thereupon, the City Authorities, having carefully studied the proposal, framed a policy and decided to grant the franchise to native business men rather than to foreign residents. When the interested people were incorporated, the concession was finally given to them.

The construction work was actually begun under the supervision of the French engineer, M. Pellegrin, and completed in the year 1872, and the public thoroughfares in Japan were illuminated with gas-lamps for the first time. Incidentally, it was just a year after the Gas-Works Clauses Act was enacted in England. Previous to this, there was a proposal to establish a similar industry in Tokyo, but it was not realized until the year 1873. The work was also carried out under the direction of M. Pellegrin; and in 1874 the streets of the Japanese metropolis were illuminated with gas lights for the first time.

It was about this time that the dawn of the new era of Meiji was breaking in this country. Those were the days of reformation and reorganization of all social and political systems, and anything which western civilization might bring us in such a transitory stage naturally made a very deep impression upon the people. Gas is one of the things in which the Japanese people took a very keen interest. Its brightness contrasted strongly with the petroleum oil lights hitherto used on the public roads. But the living conditions of the people at that time could not as yet afford to utilize this new illuminant for domestic uses; and at the end of 1877 the number of gas consumers in Tokyo was only nineteen. It is natural that in such circumstances a gas company in these days could not make both ends meet.

In 1892 a gas business which was started by the citizens of Yokohama was afterwards placed under the direction of the municipal authorities, in order to push the business. It has since then remained under the municipal ownership. In Tokyo the gas business was originally maintained by a public fund set aside as emergency savings of the feudal Shogunate Government. In 1885 it was transferred to private ownership for the purpose of encouraging the further development of the gas industry.

During the following period of twenty-seven years, no noticeable progress was made, but about the beginning of the twentieth century a new impetus was given to the gas industry of the country.

In 1903 there were five gas companies and in 1908 the number was eight, in 1910 ten, in 1911 thirty-three; their total capital amounting to 37,940,000 yen.

The Expansion Stage.

After the Russo-Japanese war in 1904-5, just at the time when a sudden and intense activity occurred throughout all business and industrial circles, the practical utility of gas for heating and lighting purposes was universally recognized; and

with the development of other industries in this country, the gas business also began to make remarkable progress, as shown in the following table.

Year.	No. of Manufacturers.	Capital Invested.	No. of Consumers.	Amount of Gas Produced.
		Yen.		C.Ft.
1911 . . .	33	..	..	3,700,000,000
1912 . . .	75	46,662,980	494,391	4,359,643,893
1913 . . .	75	58,355,623	599,043	5,645,907,745
1914 . . .	88	77,715,350	643,469	6,052,165,870
1915 . . .	91	81,098,885	611,007	6,224,383,966

The above table shows that the number of manufacturers increased by fifty-eight at the rate of about 175 p.ct. within a period of five years.

Due to the nature of the industry, which keeps pace with the advance of civilization, and to the advantages which the business is assured by monopolistic contracts with municipalities or other self-governing bodies, a boom in gas enterprise became evident; and the highest record of the increase of the number of companies was reached in 1915. Their invested capital increased by 73 p.ct. in this year, as compared with 1912. In 1914 the consumers numbered 643,469—the highest record in the thirteen years ended in 1924.

The gas industry was originally intended for street lighting. The remarkable increase in its use for that purpose may be seen in the following table.

Year.	No. of Street Lamps.	No. of Openings for Lighting.	No. of Openings for Heating Use.	No. of Gas Engines.
1911 . . .	..	841,014	387,802	2089
1912 . . .	6599	1,199,708	591,240	2347
1913 . . .	9094	1,454,701	768,076	2020
1914 . . .	9525	1,544,115	907,480	2691
1915 . . .	9283	1,551,861	1,040,477	1970

The Period of Depression.

With the development of the gas industry, there came also a remarkable development of the electricity industry in Japan. During the period of eight years from 1907 to 1914, the number of electric light consumers increased fifteen times, reaching 3,270,000 in 1914. The number of lights reached 8,420,000—roughly, a ninefold increase. The number of electric motors reached over 42,000. It can be seen from the foregoing figures that, if compared with the record of 1915 of the gas lights, which then numbered 1,551,861, the development of the electric light business during the same period was really phenomenal.

It is natural that this new electric lighting and power should make a great change in the development of the gas industry. From about the year 1914 this became more evident, as seen in the following table.

Year.	No. of Street Lamps.	No. of Openings for Lighting Use.	No. of Gas Engines.
1915	9283	1,551,861	1970
1916	8927	1,527,713	1921
1917	8775	1,417,872	1703
1918	5472	1,329,372	1531
1919	3860	1,217,094	1469
1920	2925	1,239,331	1184
1921	2335	1,224,776	966
1922	2117	1,159,641	867
1923	1654	401,995	699
1924	1180	518,624	559
1925	1091	609,005	497

As shown in the last table but one, the street lamps and gas engines reached a maximum in 1914, but since then they have gradually decreased year after year. If the maximum number in each case be represented by 100, the reduced number of street lamps and gas engines for 1925, as shown in the above table, would be represented by the figures 11·45 and 18·47 respectively, as compared with 1914, and those lamps and gas engines which remain are kept either for the street service for municipalities or other self-governing bodies, or as a reserve in case of a shortage of the electric power supply.

Regarding the use of gas for lighting, as set forth in the table above, it also showed a tendency to decrease gradually after 1915, until the year 1923, when the great earthquake destroyed a large part of the gas fixtures in Tokyo and its vicinity; and in 1925 it diminished to 609,005 openings only—which is a decrease to 39·24 compared with the highest record, if this latter be represented by the figure 100. Thus the use of gas for lighting has become secondary to its employment for heating, and gas for lighting is only used to meet an emergency case when electricity goes wrong accidentally. On the other hand, the gas industry's heating service has made rapid strides in its development.

The gas industry, which received a blow both in lighting and power services by the development of electricity, was also largely affected by the economic and industrial disorder resulting from the Great War. This can be seen from the following table.

Year.	No. of Manufacturers.	No. of Consumers.	Capital Invested.	No. of Openings for Heating.	Amount of Gas Produced.
			Yen.		C.Ft.
1915. .	91	611,007	81,098,885	1,040,477	6,224,383,966
1916. .	88	585,593	75,163,214	1,066,866	7,070,308,397
1917. .	74	549,924	72,811,270	1,037,369	7,988,454,784
1918. .	77	505,401	75,073,003	1,035,012	9,177,957,824
1919. .	77	488,422	75,663,413	965,213	9,785,507,538
1920. .	77	492,214	83,687,583	956,401	10,361,780,980

As shown above, notwithstanding the fact that the amount of the capital invested in the gas industry increased by 2,588,698 yen, which is about 3 p.ct. more as compared with the amount invested six years previously, the number of consumers showed a considerable decrease, though the amount of the total production was augmented.

During the war, the price of coal went up abnormally with encouraging business conditions. The trend of the index number of wholesale prices was distinctly upward. Taking the price of the year 1900 as the basic number 100, it rose to 129 in 1912, 145 in 1916, and 421 in 1919. But the gas rate could not easily rise side by side with the rising prices of general commodities, because the gas business was at first started as a private undertaking, and its management was under a strict supervision of the city officials, with a Compensation Contract. While the index number of coal prices rose by 245·7 p.ct. in 1921 as compared with the pre-war index number of 100, the price of gas showed a rise of a little over 51·1 p.ct. only.

Under such conditions, either a dissolution of the business by liquidation or an amalgamation with an electricity company began to be talked about among the gas companies whose credit was not good enough to withstand their difficulties. In 1917 and 1918, there were twenty-three companies which liquidated, and eighteen which amalgamated with or which were purchased by other companies. Consequently, the number of consumers diminished to 488,422 in 1919, which is a decrease of over 20 p.ct. in comparison with the highest record number in 1914. In this way, we see hard times for a while in the history of the gas industry in this country.

The Period of Prosperity.

In the year 1920 the war came to an end. Needless to say, great changes have occurred in everything in the world. Of course, there was great disorder in Japanese business circles. But, as the gas industry in Japan had already gone through a long depression, it received little influence from the general post-war depression, and even entered into an age of recovery.

Year.	No. of Manufacturers.	No. of Consumers.	Capital Invested.	No. of Openings for Heating.	Amount of Gas Produced.
			Yen.		C.Ft.
1920. .	77	492,214	83,687,583	956,401	10,361,780,980
1921. .	75	502,828	89,785,967	1,009,847	10,794,453,172
1922. .	72	552,367	96,641,314	1,194,033	12,191,973,567
1923. .	72	463,746	106,181,281	396,037	11,619,096,916
1924. .	73	568,477	116,432,560	1,087,472	12,475,411,120
1925. .	73	683,087	146,296,328	1,256,178	13,830,999,811
1926. .	75	796,462	151,875,351	..	16,063,600,796
1927. .	75	838,714	..	..	..

Though there was a great set-back in 1923 caused by the disastrous earthquake in Tokyo and Yokohama, the gas industry has shown an upward development since the year 1921, until it made in 1926 an 81 p.ct. increase in the capital investment, and in 1927 a 70 p.ct. increase in the number of consumers, as compared with the figures for 1920. This development is principally due to the settlement of the question of the cost price, and the introduction of the system of scientific management in the business; both having been thoroughly studied under the direction of the Imperial Gas Association organized mostly by the gas people. On the other hand, the advance of the standard of living and the increasing cost of fuels also assisted the rapid growth of the gas industry.

Though an all-round decline in the price of fuels has taken place since the year 1920, when it was at the highest point, the prices of coal, wood, and charcoal still remain at their levels of 138 p.ct., 81 p.ct., and 159 p.ct. respectively higher than their prices in 1912, while that of gas remains at the level of only 52 p.ct. higher.

Owing to this relatively small rise in the price, the demand for gas as fuel naturally has constantly tended to increase. This has stimulated the gas companies to make every possible improvement in their business management, as well as in their engineering equipment. These things have made the cost of production much lower.

As for the profit of the business, thirty-six out of seventy companies are able to pay annually more than 10 p.ct. dividend; thirteen more than 8 p.ct.; eleven more than 5 p.ct.; four less than 5 p.ct.; and only six pay no dividend. The industry, as a whole, is now on the upward trend, and more new gas companies are being promoted in cities and towns. We can safely

conclude that the business has now recovered, and is in the prime of its development.

PROGRESS OF GAS MANUFACTURING PLANTS.

The first gas generating plants which were adopted in our country were solid-ended horizontal retorts. Subsequently, owing to the necessity of meeting the ever-increasing demands for gas in large cities such as Tokyo, Yokohama, Osaka, Nagoya, and Kyoto, these were replaced with either inclined retorts, vertical retorts, chamber ovens, or through horizontal retort benches with mechanical chargers and dischargers.

With the improvement of gas generating equipments and the increase of demand for gas, the water gas generator was for the first time adopted in 1902 by the Tokyo Gas Company, in order to accommodate the seasonal changes of gas loads, and also the amount of coke produced. Since that time the gas undertakings in large cities like Osaka, Kyoto, and Nagoya have begun to follow the example of Tokyo, and to use water gas generators.

With the progress of the standard of living of the people at large after the war, the demand for gas has been largely increased; and as a consequence, how to dispose of the bye-products—for instance, coke—has become a hard problem to solve for the gas manufacturers. In 1924, the Kobe Gas Company imported at first the Tully system to solve this problem. In the reconstruction of Yokohama after the great earthquake of 1923, the Yokohama Gas-Works has been completely equipped with complete gasification plants which were manufactured by the Power Gas Corporation, in England. Recently, the Tokyo Gas Company has built its complete gasification plants of the German Strache and the Bamag Meguin type (which, however, is still in the course of experiment).

We have imported almost all types of gas generators from abroad, and we have studied them all carefully and constantly to find out the ones best suited to our own use, in order to keep down gas production costs as much as possible. The result has been that we have gathered here almost all the best types of foreign make. The following table shows the types of the gas generating equipments which were imported and which we are now using.

Types of Retort.	No. of Gas Undertakings.	No. of Works.	No. of Retorts.	Generating Capacity per Day.	Ratio.
				C.Ft.	
Horizontal type .	73	89	3095	27,744,870	43·85
Inclined type . .	1	2	500	6,500,000	10·27
Vertical type . .	2	3	176	4,702,000	7·43
Oven type . . .	4	7	210	6,622,000	10·47
Water gas . . .	4	6	21	13,500,000	21·34
Complete gas . .	3	3	10	4,200,000	6·64
Producer . . .	2	2	2	..	..

At first we depended entirely for retort materials on foreign make, but we can at present supply them easily by ourselves.

As for gas purification, the Osaka Gas Company adopted an American Koppers wet purifier in 1926; while, as for measuring gas generated, wet meters are chiefly used for station meters, though in some quarters meters of the rotary type have been introduced. Venturi and displacement meters are also experimentally used.

The gasholders in use are chiefly of the frame-guided type. In some quarters, spirally guided holders are employed. The materials for construction were at first imported from England and Germany, but they are now manufactured in our country. Stimulated by the development of the waterless gasholder in Germany, the Government Steel Works at Yawata has imported one of 150,000 c.ft. in 1926, and has been followed by the Tokyo Gas Company, which has imported recently two of a capacity of 2,000,000 c.ft. and 4,000,000 c.ft. respectively.

Growth in Gas Generating Capacity.

In all the gas manufacturing plants in Japan, the daily total generating capacity in 1926 reached 63,268,870 c.ft., of which the generating capacity of the gas undertakings in the six large cities, Tokyo, Osaka, Kyoto, Nagoya, Kobe, and Yokohama, was 50,900,000 c.ft.—that is, 80·5 p.ct. of the total amount.

Classifying the gas undertakings according to their generating capacities, there are five companies with a daily capacity of from 10,000 to 30,000 c.ft.; twenty-two from 30,000 to 80,000 c.ft.; fourteen from 80,000 to 150,000 c.ft.; twenty-three from 150,000 to 600,000 c.ft.; and seven generate 600,000 c.ft. or more.

Taking all the companies together, the daily generating capacity in 1921 amounted to 46,574,000 c.ft. This represents an increase of 109 p.ct. as compared with 1912. Of this daily total generating capacity for the whole country, 38,590,000 c.ft. is for the six large cities, which showed an increase of 105 p.ct. during the fifteen years since 1912. Again, the daily total generating capacity in 1926 amounted to 63,268,870 c.ft., which is an increase of 185 p.ct. compared with that of 1912. Of this daily total, 50,900,000 c.ft. belonged to the six large cities, showing an increase of 171 p.ct.

During the year 1926, 13,950,751,183 c.ft. of coal gas, 1,325,551,109 c.ft. of water gas, 714,101,496 c.ft. of mixed gas, 56,471,452 c.ft. of producer gas, and 16,725,556 c.ft. of natural gas were produced.

The gas-works generally carbonize powdered coal, though a few use run-of-mine coal. The gas-works operating on a small scale generally use only one kind of coal, while those working on a large scale employ more than two kinds of coal mixed together proportionally in order to obtain good domestic coke and a proper ratio of gas components. The price of coal, of course, varies according to the location of the gas-works, but on the average it runs from £1 to £2 per ton. As a result of the war, the price of coal rose suddenly in our country as in other countries, and owing to the necessity of economizing coal, the calorific value of the gas was gradually decreased.

The Gas Industry Law, which has been in force since October, 1925, has established a regulation that an engineer in charge of a gas-works must qualify himself by passing the Government examination. The Law has also restricted the contents of sulphur (less than 5 grammes in 10 cub.m.) and ammonia (less than 2 grammes in 10 cub.m.) in gas, and required the gas companies to declare the minimum calorific value as well as the pressure of gas to be supplied.

The following are the thermal values and pressures declared by the gas undertakers, approved in December, 1927, by the Government.

Calorific Value.

—	Highest B.Th.U.	Lowest B.Th.U.	Average B.Th.U.	Remarks.
In the six great cities.	415	404	406	Yokohama excepted
In other places . .	449	337	371	Natural gas excepted

Pressure.

—	Highest.	Lowest.	Average.	Remarks.
In the six great cities.	1 7/8 in.	1 1/2 in.	1 11/16 in.	Yokohama excepted
In other places . .	2 3/4 in.	1 1/2 in.	1 13/16 in.	Natural gas excepted

The average calorific value of the gas supplied is summarized in the following table from the data obtained during the year 1926.

Calorific Value.	No. of Gas-Works.	Percentage of Total Gas Manufactured.
Over 500 B.Th.U. .	2 (supply by purchase)	0·4
,, 450 ,, .	11 (one of them is supply by purchase)	18·0
,, 420 ,, .	24	66·3
,, 400 ,, .	19	6·8
,, 380 ,, .	14	2·5
Less than 380 B.Th.U.	21	6·0 (Natural gas excepted)

The fact that the calorific value of the gas supplied by the undertakers here is relatively low, as compared with Europe and America, can be attributed to the force of circumstances arising from the failure of the gas rate to keep pace with the remarkable rise in the price of coal subsequent to the war. Though the entire industry is fully awake to the need of improvement in this direction, under the present rates charged, immense difficulties stand in the way of realization, since it is only recently that the industry has been put on a firm economic basis, while the amount of gas consumed per meter is so small that the capital invested represents a high rate.

However, as the demand for gas increases and the amount set aside for reserves and depreciations grows larger through the united efforts of those engaged in the industry, it can be confidently anticipated that the calorific value of the gas supplied will attain a much higher standard, and, consequently, the existing equipment will be used to its full efficiency.

Bye-Products.

In our country, when the gas industry was still in its infancy, coke and tar were dumped into rivers or into the sea as useless. However, with the development of other industries, these bye-products came to be made use of in many different ways. Recently, the need of smokeless fuel has been felt keenly in urban districts, and coke is very much in demand as fuel for houses as well as in factories.

Coal tar is used chiefly for paving roads, in addition to its employment as a component of paints and various fuel substances. The large gas-works, such as those in Tokyo, Osaka, Nagoya, and Kobe, distil the tar for benzole, naphtha, creosote oil, naphthalene, carbolic acid, pitch, and so forth.

Though there were a few gas companies which began to make some of the dyestuffs and chemicals during the war, all of them have ceased to make them now, except the Tokyo Gas Company, Ltd.

The manufacture of ammonium sulphate was commenced in 1901 in our country, and plants for this purpose were built in the large gas-works. But the total amount produced by the

gas companies alone in 1926 was only 4529 tons, while the total production in the whole country was 147,629 tons.

DEVELOPMENT OF THE GAS DISTRIBUTION SYSTEM.

The low-pressure system of distribution has been uniformly adopted by small gas companies ever since the industry was introduced in Japan. The use of the high-pressure system has been necessitated by the increase in the amount of gas supply, together with the expansion of the business territory.

The Nagoya Gas Company installed high-pressure distribution in 1909. The Kyoto Gas Company and the Chiyoda Gas Company have adopted high-pressure distribution systems from the beginning. As they have shown very satisfactory results, many other large companies have followed their example.

At present, there are five companies which only resort to the high-pressure distribution system. Some companies distribute gas at high pressure either to their station holders or to their outlying supply district, while others use both high and low pressure distribution systems together.

The mains are chiefly of cast iron manufactured in Japan, but we also use steel pipes in some places occasionally. American black and galvanized wrought-iron pipes and fittings are mainly employed for services. Recently, however, home-made malleable iron fittings have come more in use.

At the beginning of our gas industry, all consumers' meters were imported from abroad. With the growth of the industry, however, meters made in Japan came into general use. At present, the normal size of dry meter is the 3 to 5 light type, but there is a tendency to instal larger ones.

VARIETIES OF GAS APPLIANCES.

Along with the changes in the use of gas, appliances have also undergone many modifications. Owing to the differences between the food and the mode of living of the Japanese people and those of European and American people, gas appliances have had to be modified according to the requirements of the people.

When the gas lamp was introduced in Japan, the mantle and its accessories came with it. Since then, Japanese makers have become able to supply their own goods. As it has been seen already, gas once attained an important place in the lighting business; but the development of the electric industry affected its growth unfavourably. The manufacturers of gas appliances also suffered a check in their business, except possibly in making such appliances as ring burners or rice cookers.

Gas is being used more and more for cooking in cafés and restaurants, and good cooking ranges of foreign make are greatly welcomed. Instantaneous water-heaters have been imported since about 1905, and are now popularly employed by hairdressers, in restaurants, and so on. For the central heating of offices, or private houses, gas has not been largely utilized as yet, because the construction of Japanese houses is not suited to this system. Small gas fires, however, are now very popular. A few gas refrigerators were imported from Germany and the United States recently, but they are not yet in large demand.

With the increasing demand for gas for industrial uses, many kinds of appliance make their appearance on the market, and it is noticeable that those superior in quality and efficiency are more in demand.

THE FUTURE OF THE GAS INDUSTRY.

The majority of the Japanese people dwell in low wooden houses, sit on mats, and use charcoal for heating and cooking. Besides, their primitive life and cheap labour make their living expenses very low. The expenses for lighting and heating amount, according to the annual statistics of 1927, to only 17·2 p.ct. of an average salaried man, and only 19·8 p.ct. for a labourer, of the house rent, which itself is very small as compared with the expenditure on food and clothing.

Though the gas industry has made considerable development, the number of households using gas averages only 13·5 p.ct. of the total number of households in the territory of gas companies, and the consumption per meter is 18,075 c.ft. a year. If the amount of gas used in industry is excepted, the amount per meter will be less than 10,000 c.ft. a year, which is at the rate of about 2000 c.ft. a person. Furthermore, the number of consumers per mile of main is 160 on an average throughout the country. Even in the six largest cities there are only 184 consumers per mile on an average.

Taking such things into consideration, the gas business in Japan may be said to be still in its infancy, though the future appears very bright. As a matter of fact, the number of consumers and the amount of consumption are steadily increasing. According to the census of 1925, 55 p.ct. of population in the country is concentrated in cities with populations of over 5000. The increase of the urban population will assuredly bring a much better business to gas undertakers. Large buildings which will be erected on an improved city plan will also cause a considerable increase in the demand for gas.

Gas for industrial uses is still in an early stage of development. In 1926, there were two gas manufacturers over 40 p.ct. of whose output was consumed for industrial purposes; four, over 30 p.ct.; three, over 20 p.ct.; and twenty-two, over 10 p.ct. only.

Throughout the gas undertakers have done their utmost to improve their business, to make its financial foundation steady, and to set aside as much as possible for reserves and to meet depreciation. In 1926, funds for reserves and depreciations were set aside at the rate of 4·8 p.ct. of the total fixed capital of the industry. Naturally these have contributed much to the development of the industry. For example, the amount of the fixed capital invested per 1000 c.ft. of gas made dropped to 16s. 5d. in 1925, from £1 0s. 2d. in 1921—a decrease of 18 p.ct. in four years. In short, it can be reasonably said that the gas industry of our country is now on a prosperous and sound base.

Industrial Heating by Solid, Liquid, and Gaseous Fuels.

By Sir ROBERT HADFIELD, BT., F.R.S., and R. J. SARJANT.

For the smaller types of industrial heating operations covering a wide range of service in repetition work, in which the relation of the number of articles handled to their total heat capacity is high, town gas has an important advantage as regards uniformity of heating, and its applicability to surface combustion methods admits of high radiation effectiveness.

By the courtesy of a number of the largest gas undertakings in the country, it is possible to indicate in a broad manner the extent to which its use is being adapted to industrial needs. Taking seven of the largest organizations in industrial districts, the average consumption devoted to industrial heating is about 15 p.ct. of the total make. From the years 1924 to 1927, the consumption for industrial heating increased each year by, roughly, 1 p.ct of the whole total. The largest industrial load was 47·9 p.ct. of the total for the undertaking. For the whole country, however, it is doubtful if the proportion devoted solely to industrial heating exceeds 10 p.ct. Taking an average calorific value of 475 B.Th.U. per c.ft., the town gas utilized for industrial heating is of the order of 140,000,000 therms.

The future possible industrial demand would no doubt benefit from a modification of the method of charging for the gas on the lines of the so-called "three-part" system, which has come to the fore of late, since that method permits of a more equable partition of the distribution costs as between large and small consumers, and the offer of gaseous fuel in large quantities at rates more nearly competitive with other fuels. The same result is attained to some degree by the system of lowering the rates for all consumptions beyond certain arbitrarily chosen limits, which method bears, however, only a partial resemblance to the more logical one of a sliding-scale.

Town gas is used for industrial heating in about 3000 distinct trades, in each of which it is used, on the average, for seven processes. The publications of the British Commercial Gas Association are fertile in illustrations of these. A very large number of small furnaces of low thermal capacity are in use for operations of short intermittent character, in regard to which the "lighting-up" gas consumption, necessary to bring the furnace to its working temperature, represents a very appreciable proportion of the total gas required for the heating cycle. The development of the self-contained recuperative furnace with metallic air preheating tubes, operating on the counter-current principle, reduces the "period of advantage" of the simple oven type. In addition, the use of insulation materials, hitherto largely ignored for the same reason, is now being adopted. High thermal efficiencies have been obtained with the reversing regenerator type—for example, 55 p.ct. of the net calorific value for an operation at 1000° C.

Prevention of Scaling.

It is known that the term "reducing atmosphere" in flame furnaces is a misnomer, and that to obtain entire protection against scaling an atmosphere of combustible gas must be present. Successful operation is obtained by heating in a muffle containing an atmosphere of either town gas or producer gas, and arranging for mechanical discharge of the material through a water seal.

The development of modern heat-resisting steels has made possible the conveyor and the metallic muffle for operation at temperatures up to 1000° or 1050° C. For those operations of small parts in which it is desired to protect the charge from the scaling effect of the atmosphere, and for which the gas or oil furnace offers the best heating medium, the use of boxes made of the same material, mechanically charged and dis-

charged, is desirable. The best possible combination for furnaces utilizing fluid fuels at the moderate temperatures mostly in use have proved to be well lagged types with carborundum hearths, and an adequate recuperative or regenerative system, using preferably mechanical draught.

Gas Consumption.

Subject to the limitations of variation due to local conditions, such as character of the charge, rate of heating, and temperature gradients permissible, the following may be regarded as representative of the heat required in town gas heating in a list of typical industrial heating operations:

Heat Required as Town Gas in Therms per Ton for Typical Industrial Heating Operations.

Operation.	Ordinary Oven Furnace.	Recuperative or Regenerative Oven Furnace.
Hardening	25–35	15–20
Tempering	20–25	10–15
Annealing	20–35	15–20
Normalizing	20–25	12–17
Rivet heating	55	..
Billet heating—		
950° C.	30–35	15–20
1250° C.	35–40	20–25
Forging	34–75	20–30
Plate heating	30–40	20–25

Use of Oxygen to obtain High Temperatures with Gaseous Fuels.

The future possible utilization of oxygen in industrial heating has received some attention, but the present cost of oxygen is prohibitive for commercial development. It is not likely that oxygen enrichment under these conditions will offer any advantages in normal operations, as the following statement shows. On theoretical grounds the same increment of flame intensity which is obtained by oxygen enrichment may readily be obtained by preheating the air. The measure of this increment may be indicated from an actual comparative experiment. The combustion of town gas of 500 B.Th.U. per c.ft. was enriched with 5 p.ct. of oxygen, based on the total volume of the supporter of combustion, and the increase in the working temperature of the furnace observed. The temperature without oxygen was 1570° C. and with oxygen it was 1630° C. under exactly comparable conditions of rate of gas flow, load, &c. The difference in theoretical intensity calculated from the composition of the gas was 45° C.

The Critical Rate of Heating.

An almost obvious feature of furnace control, which is, however, frequently overlooked in practice, is that there is for any given load, in either furnace or kiln, a critical rate of heating which gives the minimum values for the total heat losses in the heat balance. If the rate of heating be below this particular speed, the external losses in radiation and condition are excessive. Over-driving produces excessive loss in the sensible heat in the waste gases. The point of balance can only be obtained in practice by an actual succession of runs, for there must be an ideal rate corresponding to each type of charge. In a kiln or batch annealing furnace, the surface-weight factor is the criterion; in heating a heavy forging, or annealing box, it is the section and heat diffusivity of the material of the charge (governed in the latter instance by the insulating influence of the surfaces). In a continuous furnace the criterion is the relation which the heat absorbing capacity of the charge bears to the available heating surface.

The influence of the rate of driving is the only explanation of the results recorded in the following table, which gives the relation between the calorific value of the gas and the thermal efficiencies obtained in a shop of heat-treatment furnaces operating on town gas at a time of stress, when it became imperative for the undertaking to supply gas at a lower calorific value. The records all apply to the same load—that is, to the same rate of heat absorption in the material, which amounts to 8800 therms in each test period of a week.

Relation of the Thermal Efficiency to the Calorific Value of Town Gas for a Battery of Heat Treatment Furnaces at Approximately Constant Load.

Thermal Efficiency, P.Ct.	Calorific Value (net) of the Gas. (B.Th.U. per C.Ft. at 60° Fahr. and 30 In. Mercury.)
13·75	390
14·00	405
13·75	415
13·35	450
12·80	456
11·60	473

The ideal rates are more readily obtained by the utilization of liquid or gaseous fuels, and in general, though especially so in the case of solid fuel, their desirability provides an argument for mechanical draught control. These statements indicate that a pyrometric installation, measuring the temperature either in the furnace chamber or at the outlet of the waste gases, is an essential part of a furnace unit, to enable the time-temperature relation to be observed. Such remarks apply with special force to batch furnaces. The use of the pyrometer is needed to save fuel as well as for the technical control of the product.

Heating Saving by Recuperation and Regeneration.

The large refractory recuperator usually employed has a high capacity, which diminishes its utility in the smaller and intermittent type of furnace. Further, the fragility of the refractory material, its porosity, and the instability of the joints, constitute further important disabilities in shops where heavy vibration and hammering occur. To obtain physical stability in such circumstances, thick refractory walls are necessary. There is a limit to what car be done in this direction, because the heat transmission is seriously reduced with the thickening of the wall.

The logical alternative combining lower thermal capacity with enhanced utilization of surface for heat transmission is the development of the metallic recuperator. Until comparatively recent years, cast iron and mild steel had been mostly used. They had, however, serious limitations as regards the temperatures to which they could be heated, and only limited degrees of preheat could be obtained, of the order of 300° to 400° C. at the best. Recent metallurgical advances have, however, produced heat-resisting materials capable of being obtained not only in cast forms of a high degree of intricacy but in such machinable and malleable forms as to render possible the construction of a robust yet lighter recuperator. Further, the metallic recuperator permits high velocities to be carried, and accordingly an improved utilization of available surface since the transmission coefficients are thereby increased. Hitherto the parallel type of flow has been mostly used, since it tended to give the lowest maximum temperature in the walls. The employment of heat-resisting steels permits the use of the counter-flow type, which gives the highest degree of preheat. The most economical type for large recuperators is a combination of the cheaper types of material, cast iron, &c., for the sections working at low temperatures, up to 400° to 500° C., and heat-resisting steel for the high-temperature section.

Economics of Coke Manufacture in the Coking Industry.

By M. MACKENZIE.

Authoritative Body: The Joint Fuel Committee of The Institution of Gas Engineers, the Society of Chemical Industry, the Coke Oven Managers' Association, and the Institute of Fuel.

The close connection between the coking and the coal and iron and steel industries is a commonplace which requires no stressing. On the other hand, any critical appreciation of the economic and technical development of the coking industry in this or any other country which either ignores or does not emphasize sufficiently this interdependence is far from complete.

Again, though generally realized, due weight is seldom given to the fact that technical development is but the handmaiden of economic stress or prosperity. While one naturally expects a progressive technique in any live industry, there is no doubt that the most considerable developments have been made largely as a result of conditions of economic hardship or economic prosperity—a seemingly paradoxical statement.

An excellent illustration of this process is afforded by the evolution of the bye-product coking industry from the beginning of the present century, or by contemporary developments in Germany and America, inspired as they are in the former country by conditions of stress and hardship, and in the other by prosperity unparalleled in the history of any country.

Primarily the coking industry was established to supply an essential raw material for the manufacture of pig-iron; and apart altogether from the ebb and flow of the pig-iron industry, there are indications of appreciable growth during recent years.

In Scotland, for example, metallurgical coke has largely taken the place of the splint coal which, until recent times, was the basic fuel employed in Scottish blast furnaces. There are also indications that an increasing outlet will be found in the field of domestic and general industrial requirements; and any legislation directed towards smoke abatement in the metropolitan and urban areas would give a material impetus to the coking industry and to the carbonizing industries generally.

As the pig-iron industry has been, and is likely to remain, the principal consumer of bye-product coke, this potential expansion may to some extent be offset by the considerable advances which have been made in blast-furnace technique in the direction of reducing the fuel consumption per ton of pig-iron made, so that any natural expansion in the volume of the pig-iron industry in the next decade may not necessarily involve a corresponding expansion in the coking industry. Taking everything into consideration, therefore, it would appear that the volume of production in the coking industry should remain fairly stationary over the next few years.

While primarily established to produce an essential raw material for the manufacture of pig-iron, the coking industry has become more and more an outlet for less readily saleable grades of bituminous coals. Researches in the coking possibilities of coals of lower coking indexes by admixture with highly coking coals, and in the de-sulphurization of coking slacks generally, if they do not enlarge the sources of supply may make some compensation, at all events, for the gradual exhaustion of coals of good coking quality.

The bye-product coke-oven was designed not only to recover the gaseous and liquid products of carbonization, which in the beehive oven, with isolated exceptions, were either allowed to go to atmosphere or were used for heating auxiliary plant, such as brick and lime kilns, but also as a user of lower-quality slacks and the residual fines of coal washeries.

As the field of machine-mining widens, additional quantities of coking slacks may become available, though methods may be devised for minimizing the relatively higher percentage of small coals produced by machine-mining methods. Whatever excess there may be is likely in time to be absorbed as smokeless fuel and hydrogenation processes are perfected and commercialized.

Bearing in mind, therefore, the gradual exhaustion of highly coking coals, the possibilities of utilizing inferior coals, the *sequelæ* of machine-mining, and the invention and perfection of new carbonizing processes, the general conclusion, so far as the immediate future is concerned, would appear to be that we are not likely to experience a reduction in the price of the basic raw material of the coking industry. What we can look to the future for, however, are coals—and the writer is speaking now of that section of the industry outside of Durham—which by careful selection and treatment are capable of conversion into a product lower in ash and sulphur content, and consequently more valuable than the coke of to-day.

Extent of the Industry.

There are some 9500 bye-product ovens of various types in England, Wales, and Scotland, comprised in 154 plants, employing in round figures 15,000 workpeople, including bye-product labour. In addition, there are about 2500 beehive ovens in the country; but the figure grows less each year, and has come down from over 13,000 in 1913 to 2229 in use in 1925.

The following figures indicate the extent of the coking and bye-product industry expressed in terms of its consumption of coal and production and disposal of coke, as shown by the official figures of the Board of Trade for the years ended Dec. 31, 1924 and 1925.

At Coking and Bye Product Plants—England and Wales and Scotland.

Year.	Total Coal Carbonized.	Total Coke Produced.	Coke Consumed Inland.	Coke Exported.
	Tons.	Tons.	Tons.	Tons.
1924 . . .	18,862,492	12,753,358	10,903,667	1,849,691
1925 . . .	16,393,867	11,008,686	9,755,950	1,252,736

In 1923 the iron and steel industries consumed 8,645,700 tons of metallurgical coke, 8,744,800 tons in 1924, and 7,465,600 tons in 1925.

The total capacity of all bye-product ovens in England, Wales, and Scotland is 21 million tons of coal per annum, and the production of coke would appear to be adequate for the present actual and potential requirements of the iron and steel industries, and still leave a surplus for export and other markets.

Economic Position.

The present economic position of the coking industry in this country can, perhaps, be best explained and analyzed by a comparison between the costs and results of operation over the past twenty-seven years, with particular reference to the three outstanding types of coke-ovens which have, in turn, been employed during that period—the beehive, the bye-product waste-heat, and the modern bye-product regenerative oven.

At this stage it should be emphasized that the data given are largely parochial, and are not intended to be representative of national practice. Whatever merit they may contain will consist in the fact that due care has been taken to compare like with like—coking units of moderate and similar size being the basis of comparison throughout.

Capital Costs.

The following table sets out the comparative capital cost per oven and per ton of daily coal throughput for four types of coke oven—the beehive, the bye-product waste-heat, the bye-product regenerative, and its present-day prototype.

Capital Costs of Coke Oven Plants.

Period.	Type.	Per Oven.			Cost per Ton of Coal Carbonized per Day.
		Cost.	Capacity.	Daily Throughput of Coal.	
		£	Tons.	Tons.	£
1901–1903 .	Beehive	120	4	2	60
1904–1914 .	Bye-product waste-heat	1000	9	6	166
1919–1921 .	Do. regenerative	3400	12	9·4	360
Present-day	Do. do.	6800	15	20	340

In examining the figures in the above table it should be remembered that they are subject to variations according to the district, class of coal carbonized, and whether the coal is dry or washed. The period 1919-21 may be regarded as the time when prices were most inflated, and the cost per oven of £3400 as the peak figure for that period.

As between the original beehive oven and its successors, no comparison is intended to be drawn, for the capital cost of bye-product ovens necessarily includes the cost of the bye-product recovery plant itself; but what is interesting and apparent in the figures relating to the bye-product types (apart from the marked increase in the cost of building and constructional material) is the extent to which the change in the fabric brought about by the demand for more output per unit, and the addition of such ancillaries as modern coal and coke handling appliances, have materially added to the capital cost per oven.

Costs of Operation.

The all-in conversion costs per ton of coke, including bye-products, roughly corresponding to the periods shown in the table of capital costs, are given below. In these costs, steam, whether used for process or for mechanical work, is included under the heading "Materials," and the cost of electrical power under "General charges." Every effort has been made to reduce the comparison to a common denominator; and the apparent discrepancy between the figures for depreciation in this table and the figures calculated at a uniform rate on the figures of capital cost given above is due to the fact that these conversion costs relate to actual operating conditions, and that consideration has been given to such circumstances as the respective ages of the ovens and the probable duration of their useful life.

Comparative Conversion Costs.

Costs.	Beehive, 1901-1903.	Bye-Product Ovens.		
		Waste-Heat, 1913.	Waste-Heat, 1927.	Regenerative 1928.
	s. d.	s. d.	s. d.	s. d.
Wages	2 10·5	2 8·4	3 9·0	1 9·5
Materials	0 0·1	1 9·5	2 6·5	2 3·5
Repairs	0 6·8	1 2·4	2 7·6	1 1·0
General charges . .	0 5·9	0 4·7	1 0·0	1 0·0
Depreciation . . .	0 1·9	0 11·2	0 9·5	1 6·0
Total . . .	4 1·2	7 0·2	10 8·6	7 8·0

In the modern regenerative type there is normally produced per ton of coal about seventy therms of high-calorific gas, of which a portion or the whole may be available for other purposes, depending on whether the ovens are fired with straight coke oven gas, blast-furnace gas, producer gas, or a mixture of any of these gases. The conversion cost of this type may, therefore, be appreciably reduced where arrangements can be made for the commercial disposal of such available gas and its replacement on the coke-oven plant by lean gas or less valuable fuel. Probably the most interesting feature of these costs is the very considerable reduction which has taken place in the labour cost per ton of coke produced; and in order that they may be compared in detail, they are set out in the next page.

A considerable field of inquiry presents itself in the detailed comparison of these labour and maintenance costs—a field which it is not the present writer's intention to dwell upon, but rather to suggest as a fruitful one for closer investigation by operators and constructors alike.

With the advent of the modern oven of relatively short coking time, new departures in operating practice become possible. Documented experience would be valuable on such questions as the relative merits of operating on a twelve-hour carbonizing

Labour Cost per Ton of Coke

Category.	Waste-Heat, 1927.	Modern Regenerative, 1928.
	s. d.	s. d.
Coal handling (including drying, crushing, and blending)	0 7·5	0 1·5
General foremen	0 1·3	0 1·3
Ovens	1 7·0	0 8·0
Coke handling	0 1·5	0 0·8
Bye-product plant	0 4·5	0 4·7
General labour (including mechanical and electrical)	0 11·2	0 5·2
	3 9·0	1 9·5

In the tables of comparative conversion and labour costs, the "waste-heat" figures relate to the costs of operation in 1913 and 1927 respectively on a waste-heat plant erected in 1905.

period, and the practicability of working two eight-hour shifts as compared with longer carbonizing periods and the three-shift system.

It is generally admitted that the installation of mechanical appliances depends largely for its success on the capacity of the coking plant. Modern coke quenching and handling appliances, for example, may be a profitable investment on plants of so-called economic size—namely, those plants carbonizing upwards of 1000 tons of coal per day. It is conceivable, however, that they may be successful on plants of lesser capacity.

Comparisons might also be made on such *minutiæ* of operating and maintenance experience as self-sealing and non-sealing oven doors, and band conveyors *versus* elevators for coal handling. Any or all of these major or minor questions, in connection with which there is to-day considerable difference of opinion, would well repay detailed examination by technicians from the point of view of costs of operation and maintenance in their relation to capital cost of installation.

Results of Operation.

In examining the results of operation during the period under review, the writer would at the outset enter a plea for greater uniformity in arriving at such results. Yields of products are variously determined per ton of wet coal, dry coal, and per ton of commercially disposed coke, including breeze, and per ton of dry furnace coke.

Custom in the past has established an ascertainment of the yields calculated per ton of dry coal carbonized; and from the technical point of view, much can be said for this practice. On the other hand, where the staple product is, and is likely to remain, furnace coke, it would appear that, if costs and results of operation were expressed per ton of furnace coke, comparisons could be made which would not only act as a healthy incentive to those engaged in the industry, but also go a long way towards making feasible the collection of data for the whole industry. Such data would serve as a basis of comparison with conditions in other countries and with other processes of carbonization, such as the low-temperature process.

The following table illustrates the trend of the selling prices of the various primary products as compared with the price of coking slack. The prices prevailing in the year 1913 have been used as the basis of comparison (price index = 100).

Average Selling Prices.

Price Index for Year 1913 = 100.

Period.	Slack.	Coke.	Tar.	Sulphate of Ammonia.	Benzole.
1901–03	56	90	..	..	..
1904–06	66	76	67	88	..
1907–09	79	81	59	84	..
1910–12	79	77	78	89	90
1913	100	100	100	100	100
1914–16	108	110	80	102	128
1917–19	187	192	92	117	306
1920–22	242	255	315	140	620
1923–25	145	127	245	86	371
1927	150	122	248	62	387

Broadly speaking, these figures illustrate the marked variation which has occurred in the price of coking coal, and, in the years since the "boom" period of 1919-21, the reduction which has taken place in the value of coke, consequent on the reduced demand from the principal consuming industries, together with the reduction in the value of sulphate of ammonia which has followed on the very considerable expansion of the synthetic ammonia industry.

The trend of the prices of coke between the years 1903 and 1913 shows the initial recession when bye-product coke first replaced beehive coke and the gradual establishment of the former at the end of ten years as a product for blast-furnace purposes, if not superior, at all events of equal value, to beehive coke.

Towards the end of 1927 and during the present year there has been an even more pronounced reduction in the price of coke, the price index of which to-day has fallen to 90, while no corresponding alteration has been experienced in the value of coking slack to offset this void in the revenues of coking plants.

Present-Day Issues.

These present conditions of economic stress have brought to the fore in this country two questions which have for many years been exercising the minds of those who are most intimately connected with this industry—the centralization of small units, and the bulk supply of coke oven gas.

The coke oven industry is an integral part of our iron and steel industries, and any concentration of coking units which does not form part of a larger scheme of unification and rationalization of our principal iron and steel producing plants would possibly defeat its own object, for whatever might be gained in economy of production might in a large measure be lost by increased freight or transport costs on both the raw material and the manufactured products of the industry.

Mr. Ernest Bury, writing recently on this question of unification, and making particular comparison of conditions in the coking industry in this country and in America and Germany, stated that the large plants in America and Germany were, in most cases, put down at iron and steel works of enormous capacity, where there was a use for the coke and gas produced from the unified coking plants. There were no such unified blast furnaces and steel plants in Great Britain. He had lately returned from a visit to the Ruhr steelworks, where five units produce the equivalent of 60 p.ct. of the total steel made in Great Britain. At the Hamborn Works (Vereinigte Stahlwerke) 170,000 tons of ingots were produced per month, equal to 136,000 tons of finished steel—that is, 1,632,000 tons per annum. The smallest of the works visited—the Phœnix—produced 80,000 tons of finished steel per month. The coal carbonized at Hamborn was approximately 4500 tons per day—that is, 31,500 tons per week—the whole of the surplus gas from which was used in the manufacture of finished steel, for town use, and for the operation of the company's colliery. We had no such concentrated user of coke and coke oven gas in British steelworks. An average sized British steel unit would produce approximately 3000 tons of finished steel per week, with coal carbonized equivalent to 6000 to 9000 tons, according to economy in fuel practice.

The re-grouping of British iron and steel plants would, therefore, seem to be a condition precedent to a concentration of coking units. When it is remembered that the present building costs for steel works are approximately £20 per ton of steel produced per annum, as compared with a figure of from £8 to £10 per ton in the years prior to 1914, it will readily be realized that a very large capital expenditure is involved if we are to bring about in this country a concentration similar to that effected by the Vereinigte-Stahlwerke or the United States Steel Corporation.

Large coke oven plants are in existence at German collieries. In such cases there is no user for the gas, and Ruhr colliery proprietors are now seeking to sell such gas to all parts of Germany. Most German steelworks possess their own coke ovens, and there is, therefore, no gas outlet for the ovens at the collieries in this direction. Further, the coke produced at the collieries is to a large extent debarred from absorption by German steelworks, and the colliery coke-ovens have to seek outlets in other directions.

The general conclusion to be drawn, therefore, would appear to be that unification of coking units on the grand scale is feasible only when a user can be found for the greater part or all of the plant's output in close proximity to the plant itself. On the other hand, there is no doubt that considerable saving might be effected by the concentration of relatively small groups of small plants to form units carbonizing upwards of 1000 tons of coal per day, provided that the following conditions were satisfied:

(1) The plants to be replaced were nearing the end of their useful life, and no great loss of capital would be experienced in their extinction.

(2) The transport charges on the raw material and products of the combined plant compared favourably with the aggregate of the individual freight costs of the smaller units.

(3) A use could be found in close proximity to the new plant for its various products, including coke oven gas.

Bulk Supply of Coke Oven Gas.

In its particular application of supplies to gas undertakings, this subject has, for a variety of reasons, proved highly controversial in recent times. Whether it is or is not in the national interest is a question on which there is a divergence of opinion. There are, however, certain fundamentals which, in the opinion of the writer, do not always receive the prominence they deserve.

First, apart from such refinements as the utilization of the sensible heat of the coke as it leaves the oven, coke oven plants of moderate size are thermally self-contained units. Or to modify that statement slightly, and so to satisfy the precisian, they are, as a rule, connected with other undertakings—collieries or steel plants which readily absorb whatever small surplus of gas there may be available, either for steam raising, power generation, heating soaking pits, billet furnaces, or the

like. It follows that there is, broadly speaking, no such thing as gas surplus in the sense that it is not consumable at or near the point of production. In other words, there is no waste gas, and coke oven gas is not a *waste* product.

While in the sense referred to there is no surplus gas as such, there is, and will be available for purposes more economically suitable than those described above, an increasingly larger quantity of gas which can and should be replaced by fuels less costly and equally effective for what might be termed the cruder or more wholesale uses which coke oven gas has served in the past. We are, therefore, dealing with a question of margins rather than that of absolute values—the margin between the value of coke oven gas to the coke oven operator in terms of raw fuel, such as steam coal or some other replacing fuel, such as blast-furnace gas, and its value to the statutory producer of gas for domestic and allied purposes. Both these values are capable of exact determination.

Secondly, assuming (*a*) that the statutory producer or gas-works undertaking has been given the adequate safeguards to which he is unquestionably entitled, (*b*) that there is, for the sake of argument, in this country a source of demand, figuratively speaking, on the doorstep of the principal centres of the coking industry, sufficient to absorb the available quantities of coke oven gas without distributing this gas to the urban areas remote from the industrial North, then it would appear that this question is one for co-operation, to their mutual advantage, between the interested parties on the spot; and in this connection it is pleasant to record that there is a growing recognition of this spirit of co-operation between the two carbonizing industries.

CONCLUSION.

A few words here as to the possible economic future of this industry may not be inappropriate. The stress, which in Germany seven or eight years ago gave the requisite impetus to the radical rehabilitation of their iron and steel industries, is to-day being very keenly felt in Great Britain, and indications are forthcoming that similar reactions may ensue. Associated with this impetus, the more rational attitude of all political parties towards industry in general and the basic industries in particular, together with the growing co-operation between the two great carbonizing industries, should go a very long way towards the re-establishment of the coking industry of this country on an economic basis, which would bring in its train undoubted benefits and material assistance to the industries with which it is allied and of which it forms a part.

Industrial Gas in the United States—Growth and Trends.

Co-Operative Paper prepared by the AMERICAN GAS ASSOCIATION, represented by H. O. Andrew; A. M. Apmann (Chairman); C. W. Berghorn (Secretary); J. P. Leinroth; H. O. Lobell; F. C. Mackey; and J. B. Nealey.

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If we look towards the future, and study the trend of industry, the use of gas as an industrial fuel is of great importance, because the demand and need for gaseous fuel is rapidly increasing. During the past twenty years the sales of gas for industrial purposes by the manufactured gas industry has increased thirtyfold, until to-day approximately 25 p.ct. of all gas sold by public utilities is used in industry. Fundamentally, from a cost standpoint, gas can be made considerably cheaper than electricity; and we must consider gas as the more logical fuel of the two.

The use of gas in the various non-ferrous metal fields is increasing at a tremendous rate. A large percentage of the aluminium ingots are melted in gas-fired reverberatory furnaces, and after casting are heated before rolling in continuous billet-heating furnaces. After the sheets are drawn, the aluminium utensils and parts have the stamping strain removed by annealing in continuous gas-fired furnaces. Extrusion presses continuously force the lead conduit which is used for plumbing work and for covering electrical conductors in an unending length. In many cases the cable, after being wound, is directly coated with lead covering at the outlet of one of these gas-fired extrusion presses. The temperature control at the point of covering is so delicate that the lead alloy must be kept in a mushy condition, neither entirely solid nor entirely liquid. On the other hand, the melting pot must have sufficient capacity rapidly and cheaply to melt all the lead which is necessary for this great production operation.

The use of gas for die-casting aluminium and brass is widespread. Gas finds its application in making the base concentrated alloys which are later mixed with aluminium to give the die-casting the desired composition, and in heating the reservoir of the die-casting machine proper.

The trend towards gas utilization in the brass industry is manifested in the development of new metal retort furnaces which eliminate much of the labour previously used in the crucible furnace by tilting and emptying the charge directly into the moulds. The close control of temperature possible in tinning baths, to prevent flashing of the oil covering, and to give a uniform coating, makes it necessary to use the very refined and over-all inexpensive gas fuel.

In the galvanizing of iron and steel articles, the nature of the dross which is formed between the zinc oxide and iron calls for a unique application of heat, which alone can be supplied by the radiant energy and rapidly conducted heat of properly designed gas-fired equipment.

In the production of food products the inherent advantages of gas, such as flexibility, control of time and temperature, space saving, &c., play their part as in all other industrial processes requiring heat, but with special emphasis on the factor of cleanliness.

In point of volume, the greatest quantity of gas consumed in the production of food products is for cooking. Some 10 p.ct. of the total manufactured gas consumed in the United States is used for this purpose by hotels and restaurants alone, without counting home cooking. Manufactured gas is so well adapted for the work that in large metropolitan areas, such as Chicago and New York, about 80 p.ct. of this total commercial cooking load is now on gas. Future growth in this activity will come primarily from enlargements in population and the extension of gas service to rural communities, now totalling about 50 p.ct. of population, where such service is not now available.

The hotel and restaurant load is particularly desirable to the gas company, because most of this commercial cooking is done at "off-peak" hours, with a result that a minimum investment is required by the utility to supply service. No other load, including even the general industrial, affords this advantage to such an extent. Progressive utilities have been quick to realize the importance of this consumer; and in addition to supplying fuel they maintain a separate hotel and restaurant department, and send representatives at regular intervals to inspect equipment, offer suggestions for improvements, and do everything possible to make a satisfied customer.

In the food products field probably no other application offers the possibility of expansion presented by the bakers. Bread baking now carried out by competitive fuels represents to gas companies a potential load of 45,000 million c.ft., conservatively estimated, or equivalent to a 10 p.ct. increase in present national manufactured gas consumption.

At the present time bread baking is drifting more and more from the small retail manufacturer to more powerful hands, who combine national organization with large local producing centres. This indicates that the great bulk of baking will be done in large equipment by big concerns under intense competition. Realizing these facts, the Research Committee of the American Gas Association, co-operating with the American Institute of Baking, have expended considerable time and money in developing a new oven with special operating advantages in fuel economy and flexibility, with which, it is expected, a large percentage of this market will be obtained.

In the roasting of coffee, cocoa, and peanuts, practically all modern equipment is gas fired. Increased capacity, speed in roasting, and greater production per individual attendant, all make gas fuel a necessity to compete successfully with up-to-date firms. Here again the advantages of temperature and control appear, and by virtue of its cleanliness gas may be sometimes burned, as in coffee roasting, in direct contact with the product, with consequent high operating efficiency and uniform quality of product.

In pasteurization, canning, syrup boiling, fruit ripening, and a host of miscellaneous activities, gas plays its part. It is the one fuel that meets ideally the pre-requisite conditions of cleanliness and quality as demanded by the findings of modern science and an ever-increasingly fastidious public.

The greatest field for gas in ceramic work probably lies in glass factories. Heat is needed for practically every operation, and gas has steadily shown itself to be unequalled for the purpose. Every form of gas appliance, from little needle bunsen burners consuming a few cubic feet per hour to huge melting tanks requiring hundreds of thousands of cubic feet, are in successful and constant use. Continuous annealing leers also are gas-fired economically and with low losses.

MISCELLANEOUS USES.

The miscellaneous industrial applications of gas are almost as numerous as are the miscellaneous uses for heat. These

applications may be either direct (as heating twin pots for calorizing) or indirect (as by utilizing steam from a gas-fired boiler in a steam-jacketed kettle.

In the production of nickel and monel metal at the Huntington plant of the International Nickel Company, calcining is the first process, and is accomplished in gas-fired furnaces. The Bessemer matte, as received, contains about 55 p.ct. nickel, 25 p.ct. copper, 20 p.ct. sulphur, and less than 0·4 p.ct. iron. There are four calcining furnaces each 75 ft. long, 15 ft. wide, and 30 in. from hearth to crown of arch.

In varnish cooking exact temperature control is vital, so that fires and spoilage will not occur; and gas is the ideal fuel. The following comparative data as between gas and electricity for fast cooking varnish, and between gas and coke for insulation varnish are interesting:

Varnish Boiling.

Gas v. Coke.	Gas Fire.	Coke Fire.
Varnish boiled	1,430 galls.	195 galls.
Fuel used	23,750 c.ft.	275 lbs.
Fuel per gall. of varnish	16·6 c.ft.	1·41 lbs.
Fuel cost	$0.40	$6.50 per ton
Fuel cost per gall. of varnish	$0.0029	$0.002
Labour per gall. of varnish.	$0.0013	$0.005
Total cost per gall.	$0.0042	$0.007

Gas v. Electricity.	Gas Pot.	Electric Pot.
Weight of varnish boiled	1100 lb.	1100 lbs.
Total time of run.	11 hr. 5 min.	13 hr. 28 min.
Time to heat to 570° Fahr.	5 hr. 20 min.	7 hr. 50 min.
Fuel to heat to ,,	2100 c.ft.	380 KW.
Fuel to hold at ,,	139 c.ft. per hour	13·4 KW.
Total fuel used	3000 c.ft.	456 KW.
Fuel cost	$0.50 per 1000 c.ft.	$0.008 KW.
Cost of run	$1.50	$3.65
Net efficiency (heating up)	27·8 p.ct.	32·1 p.ct.
Over-all efficiency	16·4 p.ct.	19·3 p.ct.
Fuel per gall. of varnish	21·4 c.ft.	32·6 KW.
Cost per gall. of varnish	$0.0017	$0.0026

Lithographing at the Anchor Cap & Closure Company is accomplished by the aid of gas heat. Here modern rotary lithograph presses are direct connected with the drying ovens by travelling conveyors. The lacquer ovens are divided into two sections, as the coating must be applied to one side and then to the other with a drying in between. A recent installation here is said to be the largest lacquer oven in the world, being 122½ ft. in length. These ovens are all fired with gas directly, except the latter, which has a separate air heating chamber, and the hot air is blown in.

Growth and Future Trends.

It was not until 1905, or only twenty-three years ago, that manufactured gas began to be used to any considerable extent as an industrial fuel. It is interesting to note that in 1905 the total sales of manufactured gas in the United States were less than 120,000 million c.ft., as compared with present sales of some 500,000 millions. Of this total, sales for industrial purposes now represent nearly 137,000 million c.ft., or more than the total sales in 1905. It is also interesting that it was in 1882 that the first electric central station was built, which, in spite of the loss of the lighting load, marks the date when the manufactured gas industry really began to expand.

In the manufactured gas industry, capital charges on the production and distribution equipment utilized constitute one of the principal factors in cost of product; the ratio of gross income to total investment being approximately 1 to 5. This low capital turnover makes the load factor of the various classes of business particularly important. An analysis recently made by one of the large manufactured gas companies gave the annual daily load factors for lighting as 49 p.ct., for cooking as 74 p.ct., water heating 56·7 p.ct., hotel and restaurant 84 p.ct., industrial 72 p.ct., and house heating 28 p.ct. It can be seen that the load factors of 84 and 72 p.ct. respectively for hotel and restaurant, and the industrial loads, make this class of business very desirable from the gas company standpoint.

City gas has been shown to have all the advantages of other fuels without their disadvantages. It is fundamentally, economically, and scientifically correct. No one can study the present industrial tendencies without coming to the conclusion that its great advantages will carry more and more weight as the years go on, and that its use in industry will grow enormously.

Discussion on the Carbonization Industry: Section G.

On Wednesday, Sept. 26, Section G discussed some of the problems of the carbonization industry. The papers in connection with this section were epitomized in the General Report by Mr. F. S. Townend published in last week's "JOURNAL," in which issue several of the contributions received extended notice Sir DAVID MILNE-WATSON, D.L. (Governor of the Gas Light and Coke Company, and Chairman of the Section), presided, and in opening the proceedings said that a striking feature of the General Report was the great unanimity displayed by the several contributors—regarding, for instance, the desirability of locating future coking plants in proximity to iron and steel works.

Mr. R. RAY (Vice-Chairman of the Section) dealt with one or two problems with a view to stimulating technical discussion. Referring first to methods of coke quenching and cooling, he said it was obvious from a perusal of Mr. Colquhoun's paper, that the general decision reached was that, of all the wet methods of quenching coke, that of remote quenching was most popular—and, he imagined, rightly so. Possibly delegates from Germany, where experience of coke quenching by that method was greater than in this country, would be able to enlighten the conference; but, from all points of view, the system would appear to be the most successful, the most efficient, and possibly the cheapest in the long run. The dry method of cooling, which was represented by the Sulzer process, was attractive; but, though it had many advantages, such as the reduction of the percentage of breeze and dust produced, there were other factors which confined its use very definitely to particular plants and particular areas. It appeared to him that in this country the question of capital cost was a very important factor, in view of the difficulty of finding a market either for the steam produced or for the electricity which might also be produced. At all coking plants and at many gas-works there was a superfluity of cheap fuel—coke breeze and coke dust—which had to be disposed of; and at present that fuel was used to raise all the steam and electrical power required. Therefore, it was obvious that only in special circumstances would the capital required for a Sulzer plant be forthcoming. Another point upon which Mr. Ray asked for information was that of maintenance cost. Wherever coke was handled there was heavy wear and tear; and it had occurred to him on occasions, when looking at Sulzer plants in operation on the Continent, that the cost of maintenance and repairs must be heavy.

Mr. George Helps and Low-Grade Gas.

Mr. GEORGE HELPS (Nuneaton Gas Company) emphasized the claims of town gas as a fuel for every purpose, to the exclusion of all other fuels, and gave particulars in an attempt to show that it could be sold at such a price that it would take the place even of coal, without increasing costs. He did not think they were likely to be able to obtain coke oven gas regularly just as they wanted it, and as cheaply as they could manufacture town gas. He was not altogether without experience of coke oven gas, because about eight or ten years ago he had had an option on 7 million c.ft. per day, at a price of 2d. or 2½d. per 1000 c.ft. (a halfpenny per therm), and had offered it to gas undertakings in the vicinity of the coke oven plant. They were still thinking about it; at any rate, they had not bought it. In claiming that town gas could supersede all other fuels, he had in mind what those alternative fuels were—coal, coke, coke oven gas, electricity, and oil. He believed he could prove that to-day gas could be produced, and, combined with it, oil could be produced, in such a manner that the gas could be sold at less money than coal, heat for heat, delivered to the point of consumption. When he claimed that gas could take the place of coal at the same price or less, he was not referring to a quality of 500 B.Th.U. per c.ft., or to any like gas which could not be used by the consumer at the pressure at which it was supplied to them. He was speaking rather of a gas of about 200 B.Th.U. per c.ft., which would do far better in many respects, due to the ratio between gas and air, the manner in which the rich gas was sent out, and the manner in which the consumer was forced to use it. He had been making gas in this country and abroad for nearly 45 years, and if he were a big buyer of gas and were offered a 500 and a 200 B.Th.U. gas at the same price, he would take the 200 B.Th.U. gas. There were many automatic advantages in the distribution of 200 B.Th.U. gas. A given holder pressure, with 200 B.Th.U. gas, automatically applied two-and-a-quarter times more power than with a 500 B.Th.U. gas, and in this connection he invited any who were interested to visit him at the Nuneaton Gas-Works, and to see what was being done there. The Nuneaton Gas Company was producing 200 therms in gas per ton of coal, and from 10 to 15 gallons of oil, and no coke, though coke could be produced if desired. Why they wanted to lay mains underground for the distribution of gas, and at the same time cart coke above ground, he did not know. The cost of 1⅛ tons of coal at £1 per ton was £1 4s., and the labour and all other charges on that ton of coal amounted to 5s. 6d. That quantity of coal would produce 250 therms in gas at 1·92d. per therm, which amounted to £2, and 19 gallons of oil at 6d. per gallon, amounting to 9s. 6d. Thus the cost of the coal and other charges was £1 9s. 6d., and the revenue obtained from the sale of the gas and oil was £2 9s. 6d., leaving a margin of £1. The equivalent service value of gas for average domestic use, with coal at £2 per ton, was 6d. per therm, and at such a price the margin of profit over and above an ordinary 5 p.ct. became no less than £2 10s. per ton of coal gasified. That was the margin when supplying the domestic consumer with gas at

such a price that he could exclude coal. Whereas the domestic consumer paid £2 per ton for coal, however, the industrial consumer paid £1 per ton, and that was a significant margin. Thus, the 250 therms in gas had to be supplied to the industrial consumer for £1, which was equivalent to about 1d. per therm. There could be no question that gas so produced was the only fuel which would displace coal. It was an ideal fuel, and it was the best fuel with which to produce electricity. He did not look upon electricity as an enemy, because it was an ideal source of power. Finally, he emphasized that the production of gas at a price to compete with coal, as carried out at Nuneaton, did not involve the use of a special process. It was mainly a question of obtaining a gas of about 200 B.Th.U. per c.ft., by complete gasification.

In Defence of Coal.

Mr. Douglas Hay, speaking in defence of the mining industry, said he had been wondering how modern advances in fuel technology were going to help that industry. It might seem to be heresy even to ask the question, but he had never known the question fairly put and answered. Presumably in the long run advances in fuel technology would open up new markets, and so increase the demand for coal; but the immediate effect was to contract the demand. For instance, there was the replacement of household coal by gas, coke, and electricity, which meant replacing a quality of coal valued at (say) 25s. per ton at the pit-head by a quality which was little more than half that value at the pit-head. At the same time, greater efficiency in use meant that a less quantity was being used, so that there was an immediate and a severe loss to the collieries. He was constrained to remind Mr. Ridley, the author of one of the papers contributed, who seemed to object to the collieries entering the domestic coke market, that the collieries were suffering very severely from the fact that the gas-works were replacing domestic coal by gas and coke. The total tonnage of coal purchased by the gas companies was, of course, less than the tonnage which the collieries would have sold direct to the householders. Moreover, the gas companies paid the collieries barely half the price that the latter would have obtained by the direct sale of coal, and, what was even worse, the power of barter of the large companies, both gas and electric, was such as to force the price of coal supplied to them to a level which was below the cost of production by even the most efficient collieries at the present moment. Therefore, he considered it only fair that the gas companies should assist the mining industry in disposing of surplus coke oven gas, and that they should be the last to object to the collieries entering the domestic coke market. After all, the coal industry was a basic industry in this country, and the gas companies could not live without it. An equal demand for assistance might be made of the electrical industry. If the reconstruction of the coke oven plants in this country on modern lines were to materialize, so that there would be large central plants, each taking coal from a number of collieries, a use must be found for the surplus gas. His own Company was building a large central oven plant, to carbonize 1400 tons per day, and to take the slack from five collieries connected by aerial ropeway. The determining factor in deciding to construct this plant was that the Company was able to make a contract for the supply of coke oven gas to a large town. Without that contract, the scheme would never have materialized, because the Company had not only to pay off the capital charges on the new plant, but also to wipe out the remaining value of the old plants, which in many cases were still dividend producers. In general, however, Mr. Ridley's remarks were quite fair, and he welcomed them as indicating a change in the attitude of the gas companies. At the same time, he pointed out to Mr. Ridley that recent contracts did provide for a reasonable variation in the amount of surplus gas supplied from the ovens to the gas concerns.

It had been suggested in the paper by Mr. M. Mackenzie, on the economics of coke manufacture in the coke oven industry, that machine mining produced more small coal than did the old hand-cutting methods. That was not his (Mr. Hay's) experience, and so far as South Yorkshire was concerned the contrary was the fact. The British market still demanded a large percentage of round coal, and modern methods of mining were as a rule directed towards reducing the amount of small coal made. This restriction tended to reduce output and increase cost; and anything that fuel technology could do to increase the demand for small coal sizes would be a help to the mining industry. This tendency was, in fact, observable; but he pointed out that the replacement of large and expensive fuel by small coal sizes must tend to increase the cost of the smaller sizes, and for this reason he agreed that the cost of coking smalls was likely to increase. In fact, coal prices generally, except in the case of the largest sizes, were likely to increase in the future rather than diminish, if even the more efficient collieries were to be made financially sound. Wages in the mining industry could not be kept at the present low level; also, depths were becoming greater, seams were becoming more difficult to work, the coals dirtier, and the miner's working day would tend to shorten. All these factors would tend to increase the price of coal to the carbonizing industries, and it was to advances in fuel technology that he looked to make the coal worth more.

Coke Ovens in Gas-Works.

Mr. L. H. Sensicle suggested that the gas industry could help the coal industry by manufacturing coke for domestic use, particularly if the market for domestic coke be increased—and there was great scope for increasing it. The more coal the gas industry carbonized, the better the outlook for the collieries. Of course, the natural consequence of the adoption of such a policy was that another outlet must be found for the gas made at the coke ovens. In France and Belgium in particular, the introduction of synthetic processes had brought about the extraction of hydrogen from coke oven gas and its utilization in the production of synthetic ammonia, as well as in the hydrogenation of naphthalene; and its employment had even been suggested for hydrogenating coal itself, for the production of synthetic oil. Thus, there were numerous potential outlets for coke oven gas. In considering coke oven gas supplies, the gas industry had a somewhat different outlook from that of the coke oven industry, because the functions of the gas industry were divided into manufacture and distribution. Only one-third, or perhaps less, of the selling price of the gas to the consumer was represented by manufacturing costs, and a greater amount than this represented distribution costs. Therefore the gas industry must always look upon the distribution side as being of great importance. It had been a well-known saying that profits were made in the retort house, which suggested that it was not safe to economize on the distribution side, because, if that were done at any time, the industry would be building up trouble for the future. Furthermore, in connection with service to the consumers, it was very necessary to maintain a high standard of excellence, and to be progressing continually. Therefore the manufacturing side was looked to as affording facilities for such economies as would increase profits. Thus, if the gas industry were to take gas from the coke oven industry, it would be giving up one of its chief sources of profit; and it had to safeguard its interests. When making a contract for the supply of coke oven gas, it was very necessary to consider future developments in gas manufacturing practice; and it must not be forgotten that processes similar to those used in the most modern coking plants were being considered by the gas industry itself, because the recent developments in coking practice had rendered carbonizing methods more flexible. Hitherto the gas industry had been forced to use less economic carbonizing units, because those units had had to deal with the fluctuations of demand at different seasons of the year. It was possible, however, to keep the modern compound regenerative oven working on a steady throughput of coal, at the same time meeting fluctuating demands for gas by burning some of the gas under the ovens, if necessary, when the output increased beyond the demand. It might seem heresy to suggest the burning of rich gas under the carbonizing units; but when it was remembered that the utilization of coke ovens of the latest regenerative type in a large gas-works was the means of effecting enormous reductions in the cost of manufacture, the value of the gas did not assume the same importance as previously.

Another point to be remembered was that the gas industry, in fixing the price to be paid for coke oven gas, had to consider the question of providing stand-by plant and stand-by gangs of workmen for employment in case the coke oven companies defaulted. The gas industry had to fulfil its statutory obligation, and to supply gas all the year round at a certain pressure; if it failed, it was penalized. It ought to be possible, by legislation, to transfer that obligation from the gas company to the coke oven company, because this would redound to the public good, in that uneconomic plant would not have to be kept, and wages would not have to be paid unnecessarily.

Carbonizing Economics.

Mr. Thomas Hardie (Chief Engineer of the Gas Light and Coke Company), dealing with the economic considerations affecting the carbonizing industry, said that the gas engineer had for some years had every reason to be satisfied with the progress of his industry. The consumption of gas had continued to increase steadily, the cost of production had been reduced, the efficiency of his processes had been increased, maintenance of the plant to the most modern standard had been possible, and the selling price of gas had shown a steady reduction, while the demand for gas coke for domestic purposes had exhibited a satisfactory and steady increase. With the internal economics of the metallurgical coke industry he (Mr. Hardie) was not so familiar, but all was apparently not too well; and longing eyes appeared to be turned to the markets of the sister industry to meet the shortages and disappointments of its own. Co-operation between two industries so closely allied in their raw material and in their products would appear desirable. While it was very many years since the first surplus gas from coke ovens was purchased by a statutory gas undertaking in this country, the markets for the main products of the two industries had been so different in the past that, except in the case of the less important bye-products, no approachment to joint marketing had been made, nor was it necessary. Possibly the fact that the coke oven owners were also largely the purveyors of coal to the gas industry made them consider it undesirable in the past to disturb what was a lucrative market for their coal, and the two industries had continued to work in their own particular fields; the collieries being satisfied with the profits upon the coal they sold to the gas-works and the profits from the coal they treated in their own ovens.

Conditions had now altered. Depression in the iron and steel trades had resulted in a falling-off of the demand for metallurgical coke. He gathered, from Mr. Mackenzie's remarks, that in his opinion, even should the steel trade recover, such improvements were being made in its productive methods, effecting an economy in coke, that the future demand for metallurgical coke would with difficulty reach the demand of past years. The question which faced coal owners, then, was how best to restore the profits from their coke oven activities. It was only natural, when proposals for the domestic utilization of surplus oven gas on the Continent and elsewhere were the subject of much discussion, that similar ideas should be brought forward in this country, though it was well that the difference in the conditions of the industries of the two countries should receive careful consideration.

The gas industry was quite prepared to consider such proposals sympathetically, but they did wish to be satisfied, outside the question of price, that their consumers would not suffer either in the security or in the efficiency of their supply, and that the national interests of the community would in no way be deleteriously affected. The raw material treated by the two industries was almost identical, and there was little difference in the market prices of their coal. The resulting products were much the same, though the value of gas coke had for some years exceeded that of oven coke. The principal difference in the financial results of the processes, however, lay in the fact that the gas industry produced for sale about 8000 c.ft. of gas more to the ton of coal, and from 3 to 3½ cwt. less of coke than the coke oven. The undoubted advantage to the gas industry of this greater gas and less coke production was definitely confirmed by the present endeavours of the coke oven owners to convert their

plants to obtain more nearly the results of the gas plant. From a broad view it was clear that gas plant with equal priced coals would produce gas more cheaply; and fancy comparisons with selling prices of domestic gas, or even with prices of gas into holder—unless proper allowances were made for the varying load the gas manufacturer had to meet, for the increased maintenance due to the necessity of replacing out-of-date plant, for the condition of wages, welfare of employees, and other advantages gained by many years of arduous development—were unreliable.

WHEREIN LIES THE "SNAG."?

The installation of coke ovens had been considered by all the largest gas undertakings, but only in one case were ovens installed, and, though that was many years ago, it had not been repeated. (In the current issue of the "GAS JOURNAL" it was stated that those ovens were for sale.) Even when operating on a base load it was difficult to see wherein the coke oven was going to obtain the extra 3½d. to 4½d. per 1000 c.ft. with which its surplus gas must be charged in order to meet those basic items which Mr. Ridley had shown to be so essential for a gas undertaking to take into account when purchasing coke oven gas.

It would appear, then, that there was a "snag" somewhere in the low price at which the coke oven plant was reputed to be able to supply gas; and it was satisfactory to have the assurance of the President of the Board of Trade that the inquiry recommended by the National Fuel and Power Committee into the possible supply of towns from coke oven installations would be made, when the mystery would no doubt be explained. The similar schemes which were now commencing in Germany were often quoted without mention of the fact that by far the greatest portion of the gas was, or would be, absorbed by steel works. It was stated in a paper before another Section of the Conference that in America 62 p.ct. of all the surplus coke oven gas was used in steel works. It would be interesting to know what was the percentage in this country. Mr. C. P. Finn and Mr. Ray, in their paper, considered the ideal condition to be the erection of coke ovens as a portion of iron and steel works; and this opinion was confirmed in other papers presented to the conference—notably by Dr. Bansen, of Germany, and M. Berthelot, of France. Wherever this co-ordination had taken place, success appeared to have attended coke oven operations. Mr. Mackenzie had gone still further, and had suggested the necessity for larger steel works as well as concentrated coke oven plants. There was one combine worked in the United States which carbonized 32,000 tons of coal per day, and which absorbed the whole of its production of coke and gas in the metallurgical processes. Did not this indicate to the coke oven industry a way to success? It suggested the closing-down of their own inefficient plant, and building large combined ones, which would permit them to compete successfully in their proper markets. It appeared very desirable to give the more serious consideration to this combination of coke ovens and steel works before extensive reconstructions of oven plant situated at collieries was undertaken on the strength of a market for the gas produced and in the hope of a domestic market for coke. There would be no increase in these markets just because they were supplied from coke oven sources instead of from the gas-works.

BETTER GAS COKE.

The efforts of the gas industry to improve the suitability of coke by grading, and in educating the public to its advantages, had led to an increase in the use of coke in the homes of the people. Though there was a very large quantity of coal used for domestic purposes which could still be displaced by coke, yet the rate of progress was by no means so rapid that it could not be met by the unaided production of the gas industry. To prevent slumping in its markets, the gas industry had always found it necessary to regulate the output of coke for sale by the manufacture of water gas; and nearly 1½ million tons of coke were so absorbed in 1926. In 1927 the quantity exceeded 1 million tons. If the whole supply had been met by plant producing only coal gas, the market last year would have had to absorb 5 million tons more coke. Large quantities of gas coke were exported; the quantity last year being approximately 1 million tons. The entry of oven coke manufacturers into the domestic markets for coke would not result in any additional demand, but would simply replace a demand which was being met satisfactorily by gas undertakings, and would in addition force down the price to an unremunerative figure for all parties. No benefit would be obtained by the coal industry in general. One colliery might benefit, but at the expense of another. The gas industry had the record of being highly efficient, and its charges in this country compared favourably with those in either America or Germany; and while special cases undoubtedly existed in certain parts of the country favourable at present to the supply of gas to gas-works from coke oven plants, it was impossible, in his opinion, that the work of gas manufacture and domestic coke production could be transferred to any extent to the national advantage on a scale which would provide a solution of the difficulties of the furnace coke manufacturer or of the coal industry.

LONG-DISTANCE TRANSMISSION.

Mr. W. M. CARR (Stretford) said that many of the delegates from other countries might think that there was a great difference between the town gas suppliers and the colliery people in this country. He did not think, however, that this difference really existed. The town gas suppliers were anxious, desperately anxious, to give a supply of gas at a lower rate, and to diminish the smoke nuisance, in collaboration with the producers of coal. In considering the supply of coke oven gas, it was interesting to study what had been done in connection with long-distance transmission. There was no doubt that the load factor of a particular town's supply had a good deal to do with the question of whether coke oven gas could be made available or not. If there were a good load factor and a considerable industrial load, and the demand was spread fairly evenly over the 24 hours, then the mains for the long-distance transmission, and storage at the point of user, would be small, and the capital cost would be small, and the supply of coke oven gas in those circumstances would possibly prove economical. There were many cases, however, in which the economic conditions and the situation in respect of load factor would not permit the supply of coke oven gas, however much the gas undertakers might desire to obtain such a supply. Another point of great importance was that, inasmuch as the gas was sold on the thermal basis, it must have a constant calorific value; and many gas undertakers were pivoting their thoughts upon the question of keeping the calorific value constant, or of keeping the variation down to about 0·5 p.ct. He had heard that, with coke oven gas, variations up to 10 p.ct. had had to be met. This was a point which would have to be considered very carefully when an undertaking was to rely solely on a supply of coke oven gas for its requirements. Referring to the coal used in the coke ovens, he said that practically the whole of it consisted of the smalls which were screened out of the coal which was supplied mainly to the gas undertakings; and, therefore, if they were to rely entirely upon coke oven gas for the supply of a large area, the average price of the coal—not only the price of the smalls, but the pit price of the coal, which would presumably have to be broken down before it went to the ovens with the smalls—would have to be taken into consideration. This was a matter of importance when arriving at the price of coke oven gas for a contract covering a period of years.

COST OF COKE QUENCHING.

Mr. F. C. ELLWOOD (Wharncliffe Silkstone Collieries), commenting on the handling costs of a Greensmith coke quencher at the Wharncliffe Silkstone Collieries, as given in Mr. Colquhoun's paper, said that those figures were higher than would have been the case if the plant had been larger. They could not do with less than one man on the machine; but that man, provided the plant was constructed with a cooling wharf, could comfortably deal with an oven every five minutes. The cost of the machine was only about half the cost of the remote quencher.

RATING ASSESSMENT.

Mr. J. E. LISTER COOPER pointed out that one of the results of the taking of a supply of coke oven gas by a gas undertaking was that the rating assessment of the gas undertaking would be increased. He had knowledge of cases in which the rating assessment on gas undertakings which had commenced to take supplies of coke oven gas had been more than doubled, by reason of the fact that they were no longer entitled to certain allowances with respect to tenants' capital. One small undertaking, with an output of 74 million c.ft. per annum, had a rating assessment of under £1200; but when it began to take a supply of coke oven gas, the assessment was increased to £4500. On appeal, this was reduced to £1950. Seeing that the amount paid in rates by a gas undertaking was generally about 2½d. or 3d. per 1000 c.ft., an increase of a further 3d. per 1000 c.ft. was an important consideration.

FIGHT THE DOMESTIC GRATE.

Mr. JOHN ROBERTS (H.M. Office of Works) said he had been very sorry to note that there was antagonism between sister industries. The coke oven industry was being accused of encroaching upon the markets of the gas industry; but, rather than that these two industries should attack each other, he would prefer to see them combining to attack the common enemy—by which he meant the domestic grate. In this country, 35 million tons of raw coal was being burned annually in domestic grates. The gas industry ought to be concentrating upon the creation of a new market for coke there. He believed the coke oven and the gas industries could make a fuel which would be much superior to any domestic coal being used in the open grate to-day—a fuel which would be of universal application so far as the domestic grates were concerned.

ENCOURAGE CO-OPERATION.

Dr. E. W. SMITH, commenting on Mr. Roberts' remarks, said he had read the papers submitted to the Section, and had followed the discussion closely, but he could see no sign of an attack by one industry upon the other. He understood there was to be a Committee of some kind appointed by the industries concerned to go into this matter. Quite likely it would be found that in some cases coke oven gas could be sold at a price low enough to attract a gas company whose price for town gas happened to be high enough to justify purchasing the coke oven gas. There were other considerations, of course. He urged that those who had attended the meeting of the Section should not leave in the belief that there was an attack of one industry upon the other. There was a proper safety-first attitude on the part of the gas industry, and a proper acquisitive attitude on the part of the coke oven industry; and he suggested that the matter be left there for the present.

The CHAIRMAN, at the close of the discussion, said that Mr. Roberts had painted a picture which Dr. Smith had told them was not a very good picture; and he entirely endorsed Dr. Smith's view. The desire of the coke oven industry to sell its gas to the gas industry was well known, but the gas industry was not unnaturally shy with regard to accepting the suggestion until it knew its position. That attitude was only natural and to be expected, and was bound to be so with any well-conducted industry. So far from there being any animosity, the two industries, of their own volition, had a few months ago set up a Joint Committee to discuss certain questions arising between them. This certainly did not look like animosity, but rather indicated the desire to understand one another's position and to consider whether it were possible to help each other in the solution of the problems which had presented themselves. It was now well known that the National Fuel and Power Committee had suggested an investigation being held into the whole of these questions in connection with an area lying in the centre of England. "As this investigation was suggested by the National Fuel and Power Committee set up by the Government in 1926, and as I am a member of that Committee and a signatory to the report, I think it is possible that some people may be labouring under a misapprehension, and think that because I signed the report I approved of the proposals which were to form the subject matter of the investigation," said Sir

David Milne-Watson. "By signing the report I did not say that I approved of the proposals. I merely said that I approved of an investigation being made into all the facts. I make this statement because otherwise I might very easily be misunderstood." On the question of the desirability of the investigation, the Chairman said they did not know how much coke oven gas was really surplus, or how much of it would be surplus in the future, when the needs of the iron and steel industry were met; nor did they know whether in fact it would make the public supply of gas cheaper or dearer. They were therefore ready to fall in with the suggested Government inquiry in order to find out the facts, and to investigate the problem when those facts were disclosed. "But," observed Sir David, "I wish in conclusion again to emphasize that there is no animosity between the two industries."

Discussion on Section H: Utilization of the Products of the Carbonization Industry.

On Thursday morning, Sept. 27, Section H of the Conference discussed a number of papers dealing with the composition, classification, preparation, storage, and handling of gaseous fuels, and of the products of the carbonization industry. There were eighteen papers contributed on the subject, several of which received extended notice in last week's "JOURNAL," and these were summarized in the General Report (also published last week) prepared by Mr. T. C. Finlayson. Mr. J. TERRACE (President of The Institution of Gas Engineers) was Chairman of the Section.

Mr. E. V. EVANS (Joint Manager, South Metropolitan Gas Company, and Vice-Chairman of the Section) opened the discussion. In a reference to the paper by Dr. F. Loffler, on the application of the explosion principle to the evaluation of the heating value of gases, in which paper was described an ingenious explosion calorimeter, he said he was sure Dr. Loffler would be appreciative of the fact that one of the most difficult operations in calorimetry was the measurement and correction of gas volumes. Mr. Evans suggested that Dr. Loffler, while in this country, might take the opportunity of inspecting the recording calorimeter invented by Prof. Vernon Boys. He was certain that British and Austrian physicists had much to learn from each other on the question of calorimetry, and he regretted that there was no British contribution on the subject which would have shown the degree of accuracy attained in this country to-day. The paper by Herr Menzel, dealing with the production of gas and the recovery of other products by carbonization in the Vienna Municipal Gas-Works, was of particular interest, and showed the line of development at the leading gas-works in Austria. All nations had very much to learn from Vienna, though many people would criticize the policy of complete gasification. With regard to the paper by Dr. J. G. King (Chief Chemist to the Fuel Research Board), on coal blending and the production of solid smokeless domestic fuel, Mr. Evans commended it to the meeting as one very suitable for debate. Dr. King had forecast indirectly that the blending of coal was essential if it were required to produce a coke whose characteristics might be controlled. Prof. Cobb, in his paper on gas manufacture, had emphasized the need for high thermal efficiency in gas manufacture. Already he had shown, in collaboration with other eminent investigators, that the process of gas manufacture was one of very high thermal efficiency as compared with that of the generation of electricity. This attribute of efficient coal conservation was one of which the gas industry was justly proud, and was, indeed, one of the most valuable assets it possessed. The broad subject of coal carbonization might be divided into three divisions: (1) The question of the thermal efficiency of the process; (2) the question of economic manufacture from the point of view of design of plant and the adequate utilization of machinery and labour; and (3) the distribution of the thermal energy of coal into the compartments gas, tar, coke, and free carbon. Prof. Cobb deplored the fact that oxygen was not yet available for use industrially, and finally he had questioned whether coke might be made so reactive by the addition of inorganic compounds that the necessity for applying the process of low-temperature carbonization for the production of highly reactive semi-coke would disappear. Mr. Parrish, appalled by the continued reduction in the value of bye-product ammonia, had submitted methods for increasing the revenue to the coal carbonizing industry. His plea was for centralization, but he was all along the line faced with the difficulty of transit costs. His suggestions, however, merited very careful consideration. Referring to the paper by M. Dessemond, of France, on the gasification of fuels by liquid slag producers, he said one had to consider first the question of how easily it worked, and whether the cement which was the bye-product of the process could be disposed of effectively. M. Dessemond had stated that the plant he had referred to was making 60 tons of cement per day, and he had made the emphatic statement that it was comparable in qualities with the best Portland cement. This was most important. In building construction to-day the main charges probably were labour costs and the cost of transporting the materials to the site, so that it would pay to use none but the very best of cements, and a second-quality material would not be disposed of easily.

HIGH-TEMPERATURE SEMI-COKE.

Mr. JOHN ROBERTS stressed the importance of Dr. King's conclusion that, of the 10 million tons of coke produced annually for sale, a high proportion could, by the methods suggested in his paper, be made suitable for domestic consumption. He (Mr. Roberts) had been interested in a number of experiments carried out on a large scale with a view to improving the quality of gas coke and furnace coke, in order to render it suitable for use in the open grate; and he had been surprised at the simplicity of the method. In the experiments carried out at Ramsgate on the Woodall-Duckham intermittent vertical chamber the temperatures employed for gas-making were not disturbed in any way. The blend, which was carefully prepared beforehand, was put into the retort, and instead of being heated for 12 hours, it was heated for 8 hours; and the fuel obtained was infinitely superior as a domestic fuel to that produced normally within the same chambers. Dr. King's work appeared to have been confined chiefly to horizontal retorts. The system was applicable in certain cases to horizontal retorts, but he could imagine circumstances in which it would not be successful. The main object of the work with which he (Mr. Roberts) had been associated was to produce the same fuel in coke ovens. Incidentally, he observed that Dr. King had referred to the early experiments by the Woodall-Duckham Company as having been carried out in a narrow oven, but that oven was actually a 19-in. one. The experiments with this were not successful, but sufficient information was gathered to show that success was extremely likely with a narrow oven, (say) 14 in. wide, heated uniformly. The early experiments were carried out in an old oven which he believed had previously been scrapped. It was necessary that the coals used should be very carefully blended; but once the proper blend was obtained, the method was simple. Prior to the experiments at Ramsgate he had prescribed that the volatile content required in the coke was from 3 to 8 p.ct. if it were to be rendered readily combustible; but as the result of those experiments it was concluded that it was not necessary to have a volatile content of more than about 5 p.ct., so that the prescribed volatile content was being reduced from between 3 and 8 p.ct. to 3 and 5 p.ct. It had been shown that, if domestic fuel only was required, or if domestic fuel was to be the chief product, it was not really necessary to work at low temperature. If high yields of oils were required, however, it was another matter. The high-temperature system of manufacturing semi-coke was only a partial solution of the domestic fuel problem, and he could conceive of several low-temperature processes being successful. There was plenty of room for them. The work described by Dr. King had received support from W. H. Blauvelt, of U.S.A., who had shown in his paper on coke-oven practice and developments in bulk carbonization that he obtained a much improved coke as the result of blending. Mr. Blauvelt had stated that one of the characteristics of recent coke-oven operation in the manufacture of blast furnace coke was the production of a free-burning coke having a well-developed cell structure, more reactive to the oxygen of the blast than was formerly thought practicable. Mr. Roberts drew attention to the possibility of making, at a lower carbonizing temperature (not a lower flue temperature), a fuel more reactive in the blast furnace than the ordinary blast-furnace coke. It would be valuable, he concluded, if those interested in blast-furnace practice would investigate fully the question of the most desirable temperature at which furnace coke should be made.

CARBURETTING EFFICIENCY.

Dr. R. W. GRIFFITHS (Gas Light and Coke Company) discussed the manufacture of gas from oil. The importance of fundamental information on the subject of the manufacture of gas from liquid fuels, he said, was obvious in connection with its use for the enrichment of water gas; and extensive experiments had been carried out in this direction in the laboratories of the Gas Light and Coke Company during the last few years. The results achieved he summarized briefly. When an oil was converted into permanent gas, there were four main factors which influenced the results: (1) The rate of passage of the oil through the cracking chamber; (2) the temperature and pressure of reaction; (3) the atmosphere in which the process was carried out; and (4) the character of the oil. Experiments had been carried out in these four directions, and all the results were worked out on a thermal basis—*i.e.*, the number of therms obtained as gas from one gallon of oil had been considered in relation to some other factor.

(1) Using one particular oil, the influence of the time of contact between oil vapour and the hot zone was studied, in an atmosphere of hydrogen and at a constant temperature. It was found that the yield of therms per gallon increased to a maximum as the rate of oil feed increased, and then fell again steadily. This meant that there was an optimum speed of input for a particular oil in a given plant at a fixed temperature; and the same principle held for oils of all types. When the cracking surface was doubled, without material alteration of the other conditions, it was discovered that the reactions involved occurred, not only on the hot surface, but to a considerable extent in the gas phase also. Repetition of these tests in nitrogen gave results of the same kind, and it was clear that no distinction could be drawn in this way between cracking or hydrogenation reactions, because both occurred in the gas phase and on the hot surface. At the same time,

the great increase in absorption of hydrogen at low rates of oil input showed that the hydrogenation reactions were comparatively slow, and that it was this absorption which led to loss of efficiency when the oil feed was not sufficiently rapid.

(2) On the ordinary water gas plant, pressure changes were very small, but temperature could be altered over a wide range. The maximum thermal yield of gas had been measured between 650° and 850° C., and the best results were obtained at about 750° C.

(3) The atmosphere in which cracking occurred would influence operation by the amount of hydrogen it contained.

(4) The character of the oil used for gas-making would naturally have a considerable influence on the results; and Mr. Kewley, in his paper on the manufacture of gas from oil, had pointed out the need for information in this direction. Summarizing the work carried out by the Gas Light and Coke Company in this connection, Dr. Griffiths said that about thirty different oils were analyzed and examined with respect to their behaviour on cracking under standard conditions. Yields varying from 0·5 to 1·45 therms per gallon were obtained, and comparison of the figures with those of analysis showed that hydrocarbons having a cyclic structure were far less valuable than those built up with open chains. So that, though the cyclic bodies might well give rise to some gas, yet a qualitative valuation of an oil could be made by regarding all cyclic constituents as useless.

Giving the results obtained on a full-scale water gas plant, he said that the rate of oil feed to a carburettor could be varied over a wide range even when the number of gallons consumed per run was not altered, so that in this direction there was obviously scope for development. Tests were made in which the cracking temperatures were kept as steady as possible, and the rate of oil injection was varied. The yield of therms per gallon was measured by careful observations of the necessary quantities and by calculation from gas analyses, and the results were exactly similar to those obtained on the small scale. A good deal more information of the same kind, such as figures concerning absorption of hydrogen and variations in the quality of the tar produced, had been derived from this work; and it was hoped shortly to publish an account of the whole.

Calorimetric Explosion Method.

Dr. H. A. Loffler (Austria), amplifying his paper on calorimetry by the explosion method, said he was very well acquainted with the English and American apparatus of this type. The field of application of this form of apparatus was different from that of the usual calorimeter. The explosion calorimeter was transportable, and it might be applied to tests at different stages of the production of gas. It also applied to the testing of very small quantities of gas obtained in experiments. A point he emphasized in regard to the accuracy of the explosion method of calorimetry was that of determining the ratio of air to fuel burned in the explosion. If the air were insufficient, either the explosion would not take place, or incomplete combustion would occur. Similar effects would occur if the excess of air were too large. It was essential, therefore, that a proper ratio of air to gas be obtained in the explosion chamber; and he referred to diagrams giving the exact figures as to the mixtures desirable. He used ratios of fuel to air of from 1 : 3 to 1 : 7.

Direct Recovery of Ammonia.

Mr. L. H. Sensicle, discussing ammonium sulphate production, said that Mr. Parrish, in his paper, appeared to be doubtful as to the possibilities of adopting the method of direct recovery of ammonia at gas-works, because, when referring to the adoption of such processes at coke ovens, he had expressed the view that there was no such thing as a direct process of sulphate of ammonia manufacture, and had stated that, while it was true that coke-oven recovery plants were said to operate the direct process, the last-named was more imaginary than real. Mr. Sensicle concluded that this challenge was thrown out with the object of provoking discussion by those with experience of direct processes at coking plants. Mr. Parrish had mentioned factors which he had considered were likely to militate against the effectiveness of the direct process. He had suggested, for instance, that the saturator and the mains leading from it might suffer from corrosion by hydrochloric acid, due to the dissociation of ammonium chloride. In practice, however, plants had worked for a period of years without any noticeable corrosion of the saturator resulting from the dissociation of ammonium chloride, for the reason that the chloride did not get through to the saturator. It was removed by the spray of liquor in the tar extractor. Again, it was difficult to understand how Mr. Parrish had come to the conclusion that satisfactory tar was not obtainable by the direct process, because the recovery of ammonia did not remove anything from the carbonizing products which normally went into the tar. The whole point about tar recovery in direct processes was that the heavy tar came down first—it was really a process of fractional condensation—and the lighter constituents (containing much naphthalene, light oils, and tar acids) passed on in the gas stream and were condensed out on cooling. Far from being a disadvantage, it was really an advantage, and had been adopted for a special purpose in a certain plant—*i.e.*, the purpose of road tar manufacture without distillation. The heavy tar which condensed at the outset needed only dehydration to make it suitable for the manufacture of tar macadam. The viscosity was about right, and the tar acid content was very low, which was considered to be of great advantage, having in view the complaints made in recent years that the washings from roads polluted the rivers. The naphthalene content, which was also a disadvantage in road tar, was extremely low. A further objection made to the direct process by Mr. Parrish was with regard to the devil water condensed after the saturator. There was an aqueous condensate, naturally, and it contained a high proportion of tar acids, amounting to from 400 to 600 parts per 100,000; but the remarkable thing about this effluent was that over 90 p.ct. of the oxygen absorption was due to tar acids. This was a point of great importance in connection with the pollution of rivers and the possibility of rendering the effluents innocuous, because, seeing that the chief constituents causing trouble were in this case tar acids, it was possible to treat the effluent with a benzole washing process, and remove those constituents. In the indirect process only half the oxygen absorption was due to tar acids; the remainder being due to thiosulphates, thiocyanates, and other bodies, which could not be removed in the manner indicated. They had to be treated by bacterial methods, which were very costly to operate. With regard to the vertical retort, Mr. Parrish had suggested that the undecomposed steam from the retort amounted to about 10 to 15 p.ct. by weight of the coal passing through. That seemed rather a high figure; but even if it were true, it should not be an objection to the direct recovery method, because it had been used in the coking industry hitherto, and in that case a washed coal was employed containing 10 p.ct. or more of added moisture. In the case of horizontals there was a distinct advantage, because the amount of water coming away from the coal amounted to perhaps only 5 p.ct. on the coal charge. The point raised in the paper with regard to the evaporation of the water introduced via the sulphuric acid was not of real importance, because the amount of water coming from the acid, if the acid were of only 70 p.ct. strength, amounted to only 0·5 p.ct. by weight of the coal charge, and this would not have an appreciable effect. The semi-direct process had been referred to as better than the direct process. It had been in greater use than the direct process, because of the difficulties at the outset with the latter; but recently those difficulties had been overcome, and processes were working satisfactorily and without interruption. There were many plants in the north of England and the Midlands which had worked very satisfactorily for a number of years.

More about Oil Cracking.

Dr. G. Egloff (U.S.A.), commenting on the reference in Mr. Kewley's paper to the gas made in the usual cracking process, said that presumably Mr. Kewley meant the cracking process employed primarily for the production of gasoline, which operated at a temperature of approximately 475° C. The cracking process was not in extensive use in Europe at present, but in the United States in 1927 over 200,000 million c.ft. of gas was produced at a temperature of approximately 475° C. A good deal of it was used by the gas companies for enriching water gas. In some plants the cracked gas was recracked at a very high temperature so as to increase the volume of the initial gas and reduce its B.Th.U. content from approximately 1200 to about 550. The use of cracked gas had resulted in a reduction of the amount of gas oil used.

Coke Oven Gas for Synthetic Ammonia.

Mr. E. Kilburn Scott, referring to the recent proposals for the transmission of coke oven gas to towns, pointed out that towns were very often considerable distances from the coke ovens, and the transmission would be costly, especially when the mains had to be laid in ground under which mining operations had been taking place and where the ground was sinking. It was probable that the cost of the coke oven gas when it reached the towns would be greater than the cost of producing the town gas at the gas-works. Again, if the gas were to be transported thus, it ought to have the hydrogen stripped out of it. In this connection he urged that more attention should be given to the production of synthetic ammonia from the hydrogen in coke oven gas. At a coke oven works in the north of England three or four years ago gas had been burned to waste at the rate of 2½ million c.ft. per 24 hours; and he had put forward a proposal to make synthetic ammonia. The gas contained about 53 p.ct. of hydrogen, and when this was abstracted there was left about 40 p.ct. of the original quantity of gas, which was enough to provide power to carry on the processes at the works. Furthermore, the gas was all the better for having been stripped. The calorific value of the original gas was 573 B.Th.U. per c.ft., but the hydrogen had a lower calorific value than the remainder of the gas, and when the hydrogen was abstracted the rest had a calorific value of over 800 B.Th.U. Again, it was best to strip the gas if it were sold for gas engine purposes, because hydrogen was a nuisance in a gas engine. People had no business to dissipate the assets of the country by blowing to waste large quantities of gas, or by working processes which did not utilize all the potentialities in the coal.

M. J. E. Osterrieth (Belgium), referring to the competition between synthetic ammonia and bye-product ammonia, pointed out that synthetic ammonia was practically chemically pure. Sulphate of ammonia produced from it had only those impurities which occurred in sulphuric acid. The sulphate was snow-white, and would be perfectly dried and neutralized, so that it could be stored in sacks without getting lumpy or spoiling the sacks, and could be exported. On the contrary, sulphate of ammonia recovered from gas contained traces of tar and other nitrogenous components, such as pyridine, and also had the disadvantage of humidity and acidity. To enable it to compete with synthetic sulphate, it must be dried and neutralized. There was no great difficulty in drying, but neutralization was not easy; and this was a very important point, because of the hygroscopic properties of acid sulphate.

Preheating as an Alternative to Blending.

Mr. Roy Illingworth referred to a pre-heating process as an alternative to blending, enabling coal to be carbonized rapidly at a high temperature, with the production of a highly reactive coke. In this process the coal was heated at a temperature generally below 400° C. for a short time, in order to eliminate the less stable β and γ compounds, and the resultant product could be carbonized in ordinary ovens to produce a coke of high reactivity. The pre-heating might save about 30 p.ct. in the time of carbonization. One might have two types of coal suitable for blending, within an economic range of one another as regards price. On the other hand, circumstances might be such that the pre-heating process would be more economical. The

whole matter was one of economics, because blending or pre-heating added a considerable cost to straight carbonization.

EFFECT OF COAL SIZE ON RATE OF CARBONIZATION.

Mr. SIDERFIN (Gas Light and Coke Company) referred to some experiments carried out by his Company in connection with the effects of blending and size of coal upon the rate of carbonization. The first experiment was made with ordinary Yorkshire coal in vertical retorts, and the throughput obtained normally was 4·8 tons per day. In the next experiment a blend was made of the Yorkshire coal with a non-swelling coal, and the maximum throughput was 6·5 tons per day—an increase of from 35 to 40 p.ct. The blend was briquetted, but the briquettes broke down to a great extent in handling, so that the fuel consisted of some whole briquettes and a great deal of the fines as well. In the third experiment the same Yorkshire coal was graded to a size above 1 in.; all the fines being eliminated. In the ordinary crushing operations the softer coal was more or less automatically eliminated as fines, and only the hard proportion of the coal remained. Experiments on this graded fuel showed that in swelling properties it was of about the same order as the briquettes in the previous experiment. Thus, the only difference between the second and third experiment was that in the latter the fuel was graded above 1-in. size. The throughput obtained with this was as much as 8 tons per day—an increase of 70 p.ct. or more on the throughput obtained in the first experiment. These results gave the very definite impression that the rate of carbonization was influenced to a much greater degree by the size of the fuel carbonized than by the blending. Experiments which were being made constantly in the Company's experimental plant furnished data which led to the same conclusion. When a "nutty" coal was being carbonized, the rate of gas evolution in the first two or three hours was certainly greater than when carbonizing ordinary coal.

Dr. F. S. SINNATT, who pointed to the need for fundamental work on blending, described some experiments in which small single particles of coal were carbonized, in order to demonstrate the widely different structure of coal seams. The particle sizes were measured before and after carbonization, which was carried out under uniform conditions. Particles from one piece of coal of the clarain type, after carbonization, were on the average eleven times the volume of the particles before carbonization; but the maximum extent to which the particles swelled was to forty times the volume of the original particles. Thus, the layers of coal differed enormously in swelling properties. The practical point was that in order to get the maximum from a particular coal, the parts which would swell the most must be mixed with those which would not swell; and there seemed to be some critical size to which all coals must be ground in order to get the best quality of coke.

COKE QUALITY.

Dr. E. W. SMITH said it was a great pity that it should be accepted in the discussions that the 7 or 8 million tons of coke made annually by one of the largest fuel industries in the country should not be satisfactory, and that the trend of the discussion should be along the lines of introducing special methods for blending and heat treatment prior to high-temperature carbonization. There was a definite demand for a domestic solid smokeless fuel in this country; and when one heard of gas coke and coke-oven coke taking the place of anthracite in America as a domestic fuel, one wondered just how it would work here. The properties required in free burning solid smokeless fuel for the open grate were very different from those required in fuel for (say) central heating purposes—a system of heating which was very rapidly developing in this country. The fuel required for the latter purpose was similar to that used in America and on the Continent for closed stoves. In this country, unfortunately, when central heating systems were introduced it was almost invariably the case that the boilers installed were too small. These would be entirely satisfactory for burning anthracite or other concentrated fuel of that type, but they were too small for burning coke or special coalites. Thus it was necessary to consider the question of producing suitable apparatus. It would be influential if it were generally understood from this responsible conference that the inauguration by The Institution of Gas Engineers in this country of a Technical Committee to make a thorough investigation of the present coke position would be welcomed. A large bulk of the coke was already being used domestically with every satisfaction, subject to the stoves being big enough; but, owing to a reasonable proportion of the coke being unsatisfactory in some appliances, the market for the bulk of the coke was being spoiled. He believed the trouble in the gas industry was largely the same as that in the coal industry. There were 1500 or so undertakings, a few of which could afford the expenditure on the means necessary for improving conditions, but a large number of which could not handle the situation properly. Combination, amalgamation, and organization would assist very greatly. The same remarks applied in connection with the ammonia problem. It might be a little injudicious, but he strongly believed it would be a great advantage if there were bigger aggregations of gas undertakings, in order that they themselves could deal with the ammonia problem on a proper scale, instead of practically giving the material away. The economics of the industry would be assisted by grouping. With regard to hot liquor circulation for carbonizing plants, he said there was no doubt that from many points of view this was a proved success.

GAS DRYING.

Mr. CHARLES COOPER said there was little to reply to so far as the discussion on his paper "The Purification of Coal Gas" was concerned. In a reference to gas drying, however, he remarked that it was rather difficult to get the figures representing the present cost to the gas undertakings of the maintenance of their distribution systems, and on this account it was not possible to give a clear figure representing the saving which could be effected by dehydrating the gas. There were a considerable number of dehydrating plants working, however; and, speaking with all caution, it appeared to him that it was possible to save the cost of the plant in five years.

IMPROVED DOMESTIC GRATES.

Dr. J. G. KING, replying to the discussion on his paper on blending and the production of domestic fuel, urged the importance of attacking the problem of improving grate manufacture with a view to the more efficient burning of the smokeless fuels available. He had seen several new grates of the open type, and felt sure that before very long there would be a considerable increase in the amount of gas coke consumed in this type of grate. As to Mr. Roberts' point that the horizontal retort was perhaps not a suitable medium for making coke from blended coals, he said the idea in carrying-out the experiments in a horizontal retort was that it would bring out differences in coals of different blends; these differences being fundamental to the coal and not to the oven. Whether or not two types of coal would behave in a certain manner when blended depended mainly on the diluent. For example, it was shown by an experiment described in the paper that, when using the diluent constituent in a large size, a much better coke was obtained than when the diluent was used in a small size. This was explained as being due to the action of the binding constituent on the diluent. With regard to the volatile matter remaining in smokeless fuel, he said that one experiment had been carried out in this connection. Coke was made at a relatively low temperature—600° C.—and was burned in an open grate; the component of horizontal radiation being taken as the measurement of heat given out. The same coke was reheated in the same oven in the absence of air to 950° C., to remove volatile matter. It then ignited almost as easily as the original coke, but burned more slowly, and the fire lasted for a longer period. The volatile matter, therefore, did not seem to affect the coke, except to make it rather slower of combustion. This again was greatly dependent on the type of grate used; and a slight modification in the grate or the air supply might overcome this, so that the field for gas coke might be still further widened.

Mr. P. PARRISH, referring to Mr. Kilburn Scott's advocacy of the use of the hydrogen stripped from coke oven gas for the production of synthetic ammonia, asked why he had not directed attention to the utilization of the ammonia which was already available, at a price of only £3 18s. a ton. This was the problem which the bye-product industry, both coke ovens and gas-works, had to solve; and it was capable of solution. The point was that it had not been attacked, and could not be attacked except in mass. If they were to realize for bye-product ammonia what it really merited, it was necessary to centralize works and develop mass production.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Valuation of Gas-Works for Assessment.

SIR,—Mr. J. W. Napier's official statement on the activities of the Scottish Executive of the National Gas Council will generally be welcomed by the Scottish gas industry, as indicating their endeavours on the valuation question.

Presuming Mr. Napier's statement is a reply to my criticism of that body, I feel my remarks have not been without results, and that they were not even out of place, notwithstanding that I was substantially aware of their doings. The statement also confirms my opinion that the valuation under the revenue principle is in great need of overhaul.

I understand that the Institute of Municipal Treasurers and Accountants have had this matter under consideration also, and in regard to the Conjoint Conference referred to, I am not aware whether representatives from that Institute were present. If not, I think their inclusion would be beneficial. The Conjoint Conference is the most effective method of dealing with this matter from the legislative point of view, provided it does not fade into obscurity.

The reference to the impatience that arises from the absence of knowledge or from wild gesticulations after immediate results is good enough in a general way, but rather unfortunate in the particular, though it is to be noted that the "jog up" has been effective to a certain extent.

JAS. J. SCOTT.

Gas Office,
Cowdenbeath,
Sept. 29, 1928.

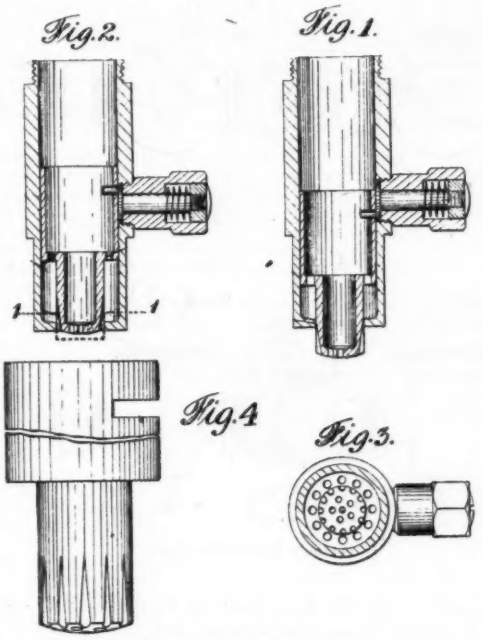
REGISTER OF PATENTS.

Valves for Burner Regulation.—No. 296,142.

STOVES, LTD., of Liverpool, and CHARLES, W. J., of Birmingham.

No. 15,025. June 7, 1927.

This invention relates to that kind of gas regulation valve wherein a manually operable valve part is slidable axially within a valve body, and the one end of the slidable valve part has longitudinal grooves varying in cross-sectional area on its periphery to co-operate with the exit of the body for varying the supply of gas from the outlet of the body. The principal object of the invention is to improve this type of valve so that it will operate without noise, also to produce a steadying effect of the gas stream by the provision of an internal baffle to the flow of the gas through the valve, and further to centralize the main gas flow and increase its rate of flow, which will affect the air injection.



A Regulator by Stoves, Ltd.

According to the invention the slidable valve part is of two diameters and has two communicating bores terminating in an exit; said diameters providing a definite shoulder which is perforated to permit the passage of gas from the one bore of the slidable valve to the exit end of the valve body. By this construction a chamber is formed by the shoulder, the one diameter and the exit end of the valve body—said chamber functioning as an internal baffle on the gas from the valve body—and the slidable valve co-operating with the exit of the body permits, it is claimed, the passage of gas from the regulator in a more noiseless manner than has hitherto been obtained.

In one example the body of the valve is arranged for its suitable connection to a gas conduit and the other end of the body is turned inwardly to provide a definite bore of a less diameter than the bore of the body. The valve part is slidable by crank action from a manually operable shaft arranged transversely of the body. The extension is also provided with a number of perforations for the direct exit of gas from the slidable valve part. On the advancement of the slidable valve part in and towards the inturned end of the body, longitudinal tapering grooves in the small diameter or extension are adjusted relatively to the inturned end of the body, and the gas passing by the perforations in the shouldered portion to the chamber and thence to the exit end of the body is regulated in noiseless manner. Details are clearly shown in the following drawings, of which fig. 1 is a sectional elevation of a complete regulator valve having the movable valve part in its maximum throttling position; fig. 2 is a similar section with the position of the slidable valve reversed; fig. 3 is a cross-section taken on the line 1—1 of fig. 2; and fig. 4 is an elevation of the slidable valve on an enlarged scale.

Water Gas Generators.—No. 296,161.

PATENT RETORTS, LTD., of Victoria Street, S.W. 1, and DAVIDSON, T. M., of Hatch End.

No. 17,667; July 2, 1927.

This invention has among its objects to provide an apparatus adapted for the complete gasification of coal and other solid carbonaceous substances; and it comprises features of method as well as features of construction.

These features will be understood from the drawings and the following description.

Fig. 1 is a sectional elevation taken transversely of division walls which constitute the main feature; and fig. 2 is a sectional elevation taken in the direction of the division walls. The generator *a* is of substantially oval or approximately elliptical cross-section, and is divided across the minor axis by the division wall *b* extending to the upper end of the generator. The tapered retort *c*, of circular cross-section, is superposed above the generator; and towards its lower end the section is gradually elongated to conform to the section of the generator. Surrounding the retort and also superposed above the generator there is provided checkered brickwork *d* contained within the jacket *e* and divided into two compartments by means of diametrically disposed division walls *f* extending between the inner surface of the jacket and the outer surface of the retort in the same

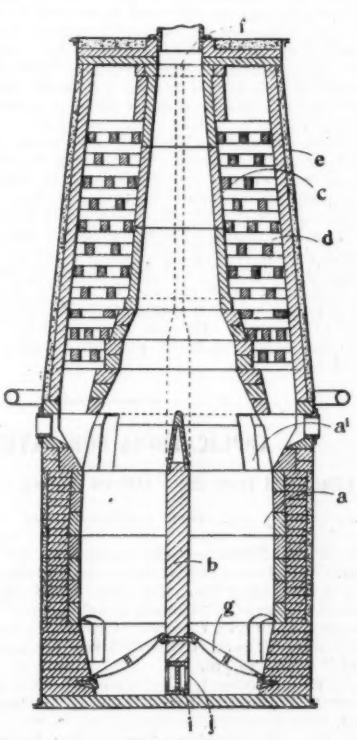


Fig. 1.

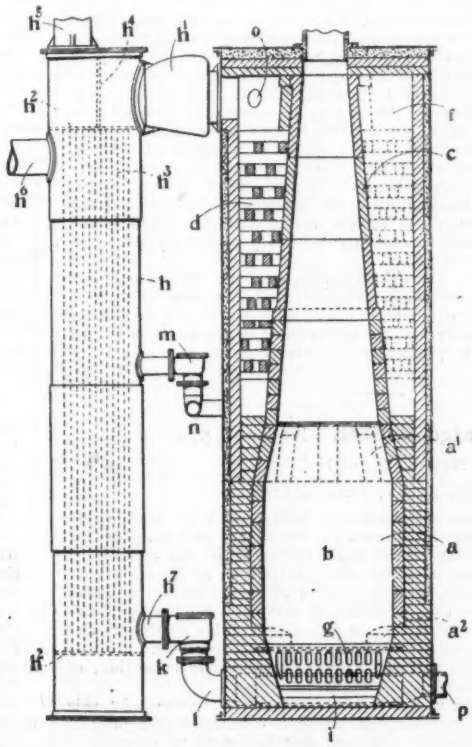


Fig. 2.

GAS GENERATOR.—PATENT RETORTS, LTD.

plane as the division wall *b* of the generator. Communication is made between the upper end of the generator and the two compartments of the jacket *e* by means of nostrils or apertures a^1 formed at the upper end of the generator and communicating with the lower end of the two compartments of the jacket *e*. At the lower end of the generator in each of the two chambers formed by the division wall *b* there is an inclined grate *g* suitably supported upon the division wall *b* and the opposing wall of the generator shell; and in the foot of the division wall *b* below the grates *g* there is an air blast supply fitting *i* comprising a two-compartment casing extending the width of the division wall and provided with a middle partition and one or more outlets *j* in each face, so that the air supply may be directed into the two chambers of the generator.

An air pre-heater *h* is disposed adjacent the generator *a* and jacket *e*, and is comprised by a cylindrical casing connected at the upper end by a fitting h^1 divided into two compartments corresponding to the two compartments of the jacket *e*, and communicating with the upper end of the compartments of the jacket *e* at a point where the checkered brickwork ends. Within the casing *h* there are two tube plates h^2 carrying the tubes h^3 of the pre-heater, while a partition wall h^4 extends diametrically from the top of the casing *h* to the upper tube plate h^2 in order to constrain the flow of the gases from the jacket *e* into the tubes h^3, first in the downward direction and then in the upward direction, so that the gases may finally escape by the outlet h^5. The compartment of the pre-heater which is formed between the tube plates h^2 is provided at the upper end with an air inlet h^6 and at the lower end with an air outlet h^7 connected to a valve *k* which is connected through a suitable fitting *l* with the air blast supply fitting *i*. Midway of the length of the pre-heater there may be provided an alternative air supply fitting *m* connected to a passage *n* surrounding the jacket *e* at the point where the nostrils a^1 open into the compartments of the jacket *e*; and such passage *n* may serve for the supply of auxiliary air into the jacket at this point. The lower end of the generator may advantageously have openings a^2 closed by suitable doors and serving to render accessible the grates *g*. Gas off-take openings *o* are provided at the upper end of the chambers of the jacket *e* for the gases of distillation or the water gas, while auxiliary water gas off-takes may be provided at *p* at the lower end of the generator.

In operation it will be understood that the blast air passes into position beneath the grates *g* and at each side of the partition wall *b*, and that the gases produced in the generator pass upwardly through the nostrils a^1 at the upper end of the generator *a* into the chambers surrounding the lower part of the retort. Air may be admitted by way of *n* for the purpose of combustion of gas on its upward passage through the checkered brickwork *d* surrounding the main length of the retort *c*, and the hot gas may then discharge into the spaces at the upper end of the setting and thus pass outwardly through the branched outlet fitting h^1 to the upper end of the pre-heater or heat exchanger *h*, passing down the tubes h^3 to the chamber at the lower end of the pre-heater, and thence upwardly through the tubes h^3 on the other side and to the snift at h^5. It will be understood that prior to the blast air entering the generator it passes into the pre-heater at the upper end by the inlet fitting h^6 and in contact with the heated tubes h^3, passing downwardly and issuing from the blast valve *k*.

The alternating periods of operation may be determined as required. Thus, for example, the blast period may continue for one minute, and thereupon steam may be admitted at the lower end of the generator beneath one of the grates for the gas making period, which may last from six to seven minutes, the grates being used alternately. The steam passes upwardly in the corresponding chamber of the generator and, by reason of the control provided, is caused to pass across the partition wall *b* and escape into the oppositely disposed compartment of the checkered brickwork, whence it escapes by the corresponding gas off-take *o*, which may be controlled by a suitable valve. This make of gas may be followed by a short down-make period or secondary treatment, when steam is admitted at the top of the checkered brickwork jacket, in the two compartments alternately or simultaneously, whence it enters, after being heated, through the nostrils a^1 and downwardly through the generator; the gas passing out through the hollow fitting provided beneath the partition wall and thence through the outlets *p* disposed opposite to the blast valve in the setting.

It will be understood, say the patentees, that the invention is not limited to the details of construction hereinbefore described. The partition wall may, for example, extend the length of the generator, or it may extend upwardly into the retort short of the extreme length thereof; or again, the pre-heater may be otherwise provided for operation.

Gas-Heated Boilers.—No. 296,574.

Naylor, S., of Halifax.

No. 25,926; Oct. 1, 1927.

This invention relates to gas-heated boilers such as are largely used in restaurants, and by caterers for the supply of boiling or hot water; and it has reference particularly to the means for controlling the gas supply. By the invention a single unit is arranged to constitute a three-fold valve, the disposition of the elements of which is preferably such that the operating or service valve portion occupies a central position, with a main gas supply valve portion to one side of it, and a pilot valve arrangement on its other side.

Fig. 1 is a plan view, and fig. 2 an elevation partly in section, of a single-unit valve according to the invention.

An inlet pipe *a* from a gas supply is connected to the inlet side of a casing *b*, the passage through which is controlled by a plug or other suitable form of rotary valve operable by means of a handle *c*. The outlet side of the casing *b* is connected to the inlet side of a casing b^1 having an outlet passage b^2 for connection to the stem *d* of a burner. The casing b^1 has also a passage or by-pass b^3 connecting the inlet passage of the casing with a pilot valve casing b^4. This pilot valve may comprise a plug or other form of rotary stopper operable by means of a handle *e*. An outlet passage b^5 from the pilot valve casing leads into the outlet passage b^2 of the centre valve. Gas can thus be passed to the burner when the centre valve is

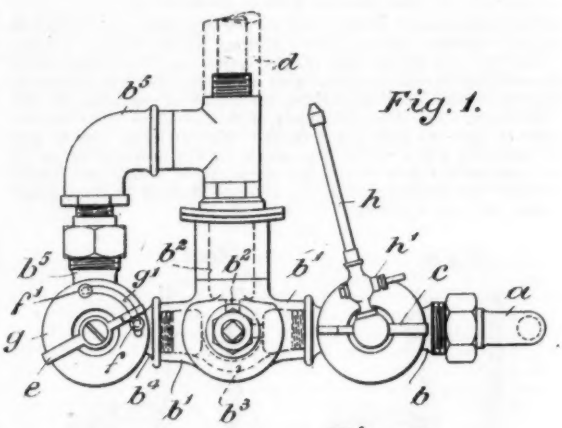


Fig. 1.

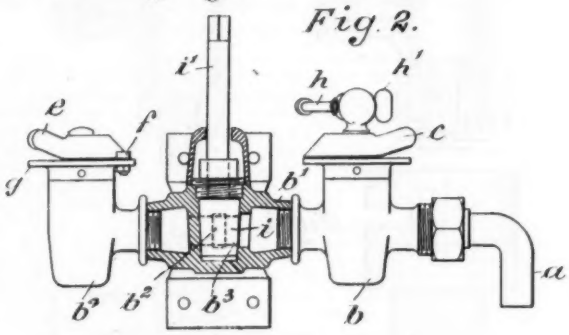


Fig. 2.

Naylor's Gas-Boiler Valve.

closed; and the quantity thus passed can be regulated by means of a stop *f* adjustable in a circumferential slot g^1 in a fixed plate *g*. This stop *f* limits the closing movement of the pilot valve, and a second stop f^1 may be provided to limit the opening movement. The pilot valve can thus be utilized, when required, to pass a relatively large gas stream.

The main gas valve may carry a swivelling lighter tube *h*, which may be swung into position as the valve is opened, and *vice versa*. If preferred, the lighter tube may be carried by the pilot valve. The lighter tube is shown as having a control cock h^1. The central valve in the casing b^1 comprises a hollow ported plug *i*; and its spindle i^1 is suitably connected with the draw-off tap of the boiler, so that the plug is turned to pass gas to the burner when the draw-off tap is opened, and to shut off the gas supply when the draw-off tap is closed.

In normal operation—that is to say, when the boiler is charged with hot or boiling water—the main gas valve is open and the service valve is closed; gas being passed, however, by the by-pass b^3 to the pilot valve to maintain the boiler heat. When the draw-off tap of the boiler is opened, the service valve is simultaneously opened, to provide a large flame to heat rapidly the water admitted to replace the supply drawn off. When the draw-off tap is re-closed, the service valve is also closed, and the boiler heat maintained by the pilot valve. The main valve enables the supply of gas to be controlled according to the supply pressure, or to be completely shut off; while the pilot valve enables the height of the pilot light to be adjusted, and also the height of flame permissible when the said pilot valve is opened to its limit.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Sept. 19.]

Nos. 25,884—26,552.

Jones, T. W. Scott-.—"Gas burners." No. 26,430.

Keith, G.—"Gas burner fittings for domestic grates." No. 26,257.

Keith & Blackman Co., Ltd., J.—See Keith, G. No. 26,257.

Koppers Company.—"Coking retort ovens." No. 26,092.

Koppers Coke Oven Company, Ltd.—"Coke ovens." No. 26,082.

Premix Gas Plants, Ltd.—"Ovens for heat treatment of sheet material." No. 26,436.

Premix Gas Plants, Ltd.—"Ovens." No. 26,437.

Premix Gas Plants, Ltd.—"Ovens for heat treatment of sheet material." No. 26,500.

Still, C.—"Purification of gases containing hydrogen sulphide." No. 26,313.

Still, C.—"Recovery of sulphur from gases." No. 26,314.

Strauschied, H.—"Gas turbine." No. 26,080.

MISCELLANEOUS NEWS.

BRITISH GAS LIGHT COMPANY, LTD.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Company was held on Wednesday, Sept. 26, at the London Offices, No. 2, The Abbey Garden, Westminster, S.W. 1—Mr. Henry Woodall, M.Inst.C.E. (the Chairman and Managing Director of the Company), presiding.

The Secretary (Mr. A. W. Brookes) read the notice convening the meeting and the Auditors' reports; and the report of the Directors and the statement of accounts for the year ended June 30 were taken as read.

The Chairman, on rising to address the meeting, said: Gentlemen, in this the 104th year of our existence we have again a good report to put before you. We have added £10,000 to the general reserve fund, £5000 to the pension and superannuation fund, and, after paying the usual dividend of 7½ p.ct., we shall only reduce the carry-forward, which now stands at £82,368, by barely £2000.

Increases Again the Order of the Day.

It is disappointing that we have to report a small falling-off in sale of gas. Increases are now again the order of the day. We had a very large increase in output for the half-year ended December, 1926. This was during the period of the coal stoppage. If this half-year were eliminated, we should have shown regular increases. The number of consumers has increased during the year by 2046, and the number of cookers issued by 2831, which indicates a sound and growing business.

It would be folly to suggest that electrical competition is negligible. We do lose some of our lighting, but gas lighting has its sphere, and is by no means finished. Only last week, at a meeting of an important Gas Company of which I am Chairman, it was reported that two factories had adopted gas lighting in face of strong electrical competition. One of the factories installed 207 high-pressure gas lamps of 750 c.p. each, and the other an even larger number. I will now deal with our stations in order.

Hull Station.

At this station the price of gas was reduced twice during the year, and to-day the charge is 7d. per therm. The accounts show that the station has earned more than the Parliamentary interest. An addition has been made to the reserve fund of £302 18s., bringing that fund up to the maximum; and the balance of profit has been carried forward as a credit to the station for the current year. The Hull accounts show that, as compared with 1927, there has been a loss in rental of £46,000, and in the amount realized by coke of £17,000; but these sums have been entirely recovered by the saving in the cost of coals, oil, and coke used in the water gas plant. In fact, the profits show an increase of £10,487 as compared with last year.

Working at Norwich.

At Norwich the year's results have been satisfactory. The price of gas was reduced by 1d. per therm from Oct. 1, 1927, and the loss on rental amounted to £20,200. The loss on the yield from coke was £14,700, but there was a saving in the cost of coals, oil, and coke used in the water gas plant of approximately £30,000, and the station earned its full Parliamentary interest. The stockholders will be interested to know that the new offices, stores, and workshops at Bishop Bridge Works are now finished, and that a large recreation room which has been erected for the use of the staff is nearing completion.

Results at Trowbridge.

The reduction in the price of gas made on Oct. 1 last has resulted in a loss in rental of £2400. Coke yielded £2040 less, but the saving in coals and oil more than covered these deficiencies. The reduction in profit of £501 as compared with last year is accounted for by exceptional expenditure on mains. Not only have many of the smaller mains been replaced by larger ones, but some extensions have been made to villages, and the result in sales of gas is already very promising.

At Holywell the reduction in profit of £106 is entirely due to exceptional expenditure on the district.

Pension Fund.

The fund has this year been increased by £5000, and now stands at £48,263. This is an accumulating fund; and we anticipate we shall be able to add to it periodically. In referring to the pension fund, I am reminded of the Prime Minister's letter to employers. The Prime Minister is right in saying he can count upon our sympathy and practical help. Our difficulty is helping the "distressed districts." Hull and Norwich have a large amount of unemployment, and it is difficult to see how we can introduce outside labour in these places. The pension fund enables us to retire our ageing men in comparative comfort, and replace them with young men, thereby decreasing unemployment in the most desirable way, and at the same time increasing efficiency.

Another thing we are doing, the "practical help," is to expedite work on improvements and extensions. We have faith in our industry and its future, and do not hesitate to provide for that future in no piecemeal manner. On this work we hope to employ men from the "distressed areas." What is wanted is efficiency and cheap gas, which will not be possible if we have men about the place who are superfluous. The solution to our difficulties will not be found in employing more men for the same work, and thereby decreasing individual productiveness, but rather in improving our methods and reducing our costs, thus enabling the country better to compete in foreign markets.

Purchase of Other Undertakings.

Last year the balance-sheet showed that our investment in other gas undertakings stood at £109,033. The figure in this year's balance-sheet is £199,500, and we are still extending our operations. In every case where we have taken over gas undertakings we have reduced the price of gas; and we can only justify our policy if a reduction in price, as well as increase in efficiency, is one of the results.

Our subsidiary undertakings now number 16, and the total sale of gas by them is rather over 300 million c.ft. The return on the capital invested is satisfactory and is improving. It generally takes some little time to put the works and mains into first-class condition; and during this period of transition the profits are necessarily limited. I am satisfied that the results from the subsidiary stations will be quite satisfactory, and will add to the stability of our undertaking. It will interest the stockholders to know that in connection with one of these smaller undertakings, which we bought just prior to the introduction of electricity, we have not had to take out a single gas meter. Though we have lost some gas lighting, the increase in the output in this small town is over 50 p.ct. We have had control here for just over twelve months.

Position of the Gas Industry.

The industry is in a sound condition. We can claim that as a whole we have been efficient; we have consolidated our undertakings, and have never paid large dividends. Our chief station, Hull, may be taken as a typical well-run gas undertaking. The total charge for capital there is 5·95 p.ct. Our efficiency is, I think, proved by the fact that our price for gas is practically the same as it was fifty years ago, though coal, our raw material, costs double what it did then, and wages—the second largest item—are considerably more than double. This is not by any means all, because gas to-day, owing to improvements in burners and apparatus, gives from twice to ten times the value per c.ft., according to the uses to which it is put, than it did fifty years ago.

In these circumstances, we do feel we should be given greater freedom. The National Gas Council, presided over by Sir David Milne-Watson, a trusted leader, has put forward most reasonable demands for the removal of restrictions; but the Government appears to have no inclination and no time to deal with them. The less fortunate industries have to be dealt with, but that is no reason why the efficient should not be allowed to increase their usefulness. The industry asks no financial assistance and no favour, but it is felt that it should be freed from restrictions which are out of date. We are spending large sums on propaganda which is necessary because of the persistent boosting of electricity by successive Governments. Gas undertakings have been definitely excluded from the scheme of rating relief. We did not ask to be relieved on our whole business, but only on the 25 p.ct. of it which is comprised under the head of "residuals." We are having to compete in coke and tar products with those who are receiving relief—in fact, the gas companies are almost being forced to sell their tar products to their competitors, the tar distillers, who are placed in an advantageous position because of the Government action. This is not fair to our industry, to the gas consumer, nor to the public.

The gas industry has done its duty well for over a hundred years. It uses coal to the best advantage. Its reputation with regard to the treatment of employees stands high, but for some reason it does not get the consideration it deserves. I suppose 90 p.ct. at least of Londoners think that Whitehall, Pall Mall, St. James's Street, Victoria Street, and others—perhaps the best illuminated streets in Europe—are lighted by electric light, whereas the lighting is by our old friend gas.

We want freedom, but we want our case heard. There are no fairer or sounder tribunals than Committees of the House of Lords and Commons or Government Departments; all we ask is that we shall have our case heard by them. Had Members of Parliament known as much about the efficiency and usefulness of gas as they have been told about electricity, in my humble opinion they would have advocated a gas grid operated by the gas industry over the country, instead of an electric one; and, at all events, we should have been spared unsightly posts carrying high-tension cables disfiguring the countryside. We are, as you know, in our small way linking up the outlying parts of our area, but we know, as the electricians do, the enormous cost of distribution; and because of this it is very doubtful if so-called grids will tend to economy.

I hope you will forgive the rather long speech I have inflicted on you, but I feel sure it is only want of knowledge of the potentialities of our industry that prevents our quickly obtaining the freedom for which we ask.

Valuable Services of Mr. A. W. Brookes.

A very interesting event took place last May, when our Secretary, Mr. A. W. Brookes, completed fifty years' service with the Company. Any company would be proud to have an official with them for fifty years; but when we recollect that Mr. Brookes is our Chief Official, and that he is, and has been, trusted by everyone in the Company, and has probably done more than any other individual

to bring the Company to its present high standing, we hardly know how to express our appreciation of his services and our high regard for him personally. Mr. Brookes had to go through an ordeal of presentations. We in London entertained him, and the chief stations insisted that he should visit them and receive their gifts, congratulations, and thanks. A cheque was presented to Mr. Brookes of 1000 guineas on behalf of the Company, and I am sure the stockholders will approve the gift while realizing how impossible it is to value the great service Mr. Brookes has rendered us. It must have been a pleasure to our Secretary to know how much respect and affection he has earned. He looks fit for another fifty years; and we all hope he will long be with us.

GOOD STAFF AND WORKMEN.

In conclusion I want to acknowledge how much we are indebted to our staff and workpeople. Our engineers are men well known and respected in the industry, and all our works have been improved during the year. Improvements in plant in all cases tend to better working conditions; and our workpeople appreciate the interest taken in their welfare. Our new properties need a great deal of attention, and our chief office staff have been very fully employed. These offices are becoming rather small for us, and we are fortunate in being allowed to add a small wing which will give us much-needed accommodation.

I have now pleasure in proposing that the report and accounts be adopted.

The DEPUTY-CHAIRMAN (Mr. Harold G. Palmer) seconded the resolution.

Mr. W. J. LIBERTY referred to the inquiry held by the Electricity Commissioners at Norwich last July, in connection with the extension of the eastern area by the inclusion of four local authorities in East Anglia—King's Lynn, Great Yarmouth, Ipswich, and Norwich. The first three, he said, applied for the insertion of the "Northumberland" clause. A settlement was arrived at with King's Lynn and Great Yarmouth, who accepted the principle of the clause. Ipswich, however, refused to insert the clause by agreement; and the case was being fought out before the Tribunal. Could the Chairman give the proprietors any information as to the effect this would be likely to have on the City of Norwich?

The CHAIRMAN replied that the Company appeared at the inquiry; but it was at the moment very difficult to understand the position in East Anglia. No competition was anticipated which they would not be able to deal with.

THE GAS INDUSTRY'S CLAIMS.

Mr. R. W. EDWARDS remarked that he was in agreement with all that the Chairman had stated in his valuable address. He felt that the gas industry ought to receive some consideration from those in authority—and that at a very early date. There was no doubt that the important part which electricity played in the Government programme, and its expansion throughout the country, were making it very difficult for the smaller gas undertakings to exist; and it seemed to him that the only way in which they could continue to exist was by becoming a part of larger undertakings, such as the British Gas Light Company, so that they would derive the benefit of experienced management and effect economies which, of course, would ultimately be reflected in the price charged for gas to the consumer. He hoped the words of the Chairman would reach the right quarter, and would, together with the efforts of other leaders of the industry, lead to the bringing of the gas undertakings more into line with modern practice. The British Gas Light Company presented an excellent organization for achieving the better administration of the smaller gas concerns throughout the country; though in saying this he did not mean to suggest that they were not equally capable of tackling the bigger ones, as, indeed, they were doing with such magnificent success at the present time. He desired to join with the other proprietors in expressing to Mr. Brookes high appreciation of the services which he had rendered to the Company, and their genuine hope that he might be spared for many years to come to enjoy not only his work and association with the Company, but also such freedom as he might desire in the latter part of his life.

Mr. G. HAY MORGAN, K.C., B.Sc., said he wished to support what Mr. Edwards had said. On the point of the delay of the Government in taking up the question of gas legislation and granting the industry a larger measure of freedom, he, too, hoped that the Chairman's words might reach the right quarter; but he could not help feeling that the gas industry had been somewhat too quiescent in the past. It had not made itself sufficiently audible in dealing with the Government. He certainly did not think the Government had dealt quite fairly with the gas industry; but a government never gave freedom because it was just, but only when it must, and the necessary pressure must be brought to bear by the people who desired that freedom. The industry should cry out a great deal louder than it had done, and then he had no doubt the Government would respond to the appeal. The Chairman, being Deputy-Governor of the Gas Light and Coke Company, and a representative of many other large undertakings, his words should go far in influencing the Government in this matter; and he sincerely hoped they would.

The CHAIRMAN said he much appreciated the remarks made by the different speakers. Mr. Edwards's opinions carried considerable weight, because he had been, as the British Gas Light Company also had been, extending his mains and linking-up smaller undertakings. He was grateful to him, and also to Mr. Hay Morgan.

THE DIVIDEND.

On the proposition of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN, the payment by the Directors of the dividend at the rate of 7 p.ct. per annum, less income-tax, on the cumulative preference stock of the Company, as mentioned in their report, was confirmed.

The CHAIRMAN next moved that the payment by the Directors of the interim dividend at the rate of 3½ p.ct., less income-tax, on the ordinary stock, as mentioned in their report, be confirmed, and that a final dividend on the ordinary stock at the rate of 4 p.ct., less income-tax, making 7½ p.ct. for the year, less income-tax, be now declared; the same to be payable on Oct. 5 next.

The DEPUTY-CHAIRMAN seconded this, and it was agreed to.

RE-ELECTIONS.

The CHAIRMAN proposed the re-election of the Deputy-Chairman, Mr. Harold G. Palmer, as a Director. He said that Mr. Palmer had been a Director for many years, and was a very useful and hard working colleague. They would be very sorry to lose him.

This was seconded by the Hon. CLIVE BIGHAM, C.M.G., and agreed to.

The CHAIRMAN moved that Mr. Graham Wilkin also be re-elected a Director, remarking that the name was a very familiar one to everybody present. He thought the Company had never been without a Mr. Wilkin on the Board; and the present gentleman of that name showed the same keenness and interest in the Company as his forbears had done. He made an excellent colleague.

Mr. LEWIS R. ABBEY-WILLIAMS seconded the resolution, which was carried.

The Auditors (Messrs. E. Knowles Corrie and William Cash, Jr., F.C.A.) were thereafter re-appointed, on the proposition of Mr. KENNETH R. MACKAY, seconded by Lieut.-Colonel W. H. T. CORRIE.

VOTES OF THANKS.

Mr. EDWARDS proposed a hearty vote of thanks to the Chairman and Directors for their able management of the business of the Company. It was, he said, a great pleasure to the stockholders to attend the meetings of the Company, which resembled a family party. The whole atmosphere was one which he felt sure must be extremely encouraging to the Directors as a body. A spirit of thoroughness pervaded the large number of undertakings which the Chairman controlled. The policy which was being pursued by the British Gas Light Company in absorbing the smaller concerns must prove beneficial. They were much indebted to the Board as a whole for the excellent report and accounts submitted, and to the Chairman for his most interesting and instructive address.

The vote was seconded by Lieut.-Colonel CORRIE, and unanimously carried.

The CHAIRMAN briefly acknowledged the vote, and went on to say that he would like to propose that the very best thanks of the meeting be given to the Secretary and officers of the Company and the staffs and workmen. Though the Directors might do their best, they could do little unless they had good officials and workmen under them. The Board were extremely well satisfied with the staffs, who were most loyal, able, and considerate, with the result that the workmen throughout the undertaking felt that their interests were not being lost sight of, and therefore served the Company excellently.

This was seconded by the DEPUTY-CHAIRMAN, supported by Mr. LIBERTY, and heartily carried.

Mr. BROOKES, in reply, said that on this occasion his acknowledgment of the vote of thanks was a special pleasure to him, because it gave him yet another opportunity of endeavouring to express his gratitude for all the kindness that had been shown him—especially just recently. Every servant of the Company must highly appreciate that vote. They felt it was an honour to be in the service of a Company which bore such a respected name in the industry. All of them had the interests of the Company at heart—including the workmen. With regard to the references to himself, he found it extremely difficult to express adequately his feelings. He had seen many changes in the Company and in the Directorate; but his service had always been a very happy one, though he had never known greater kindness than had been shown him by the present Chairman and Board. Now he had had gifts showered upon him from the Chief Office and all the Stations. The Chairman had forgotten to mention the handsome present from the Directors, in addition to the cheque for a thousand guineas. These gifts would serve to remind him of a red-letter day in his life. They would always be highly treasured; but not more so than the kind tributes which had been paid him that day, or the knowledge of the confidence that was reposed in him by the Board. He would especially like to thank the Chairman for his extremely kind references to his service, and Mr. Edwards, Mr. Hay Morgan, and Mr. Liberty for what they had said, as well as the proprietors for the cordial manner in which they had received the vote. He could not conclude without saying how much he was personally indebted to the officials at the various stations and in London. The Engineers were always willing to give him the benefit of their technical knowledge, and as to the London staff they invariably rallied to his support. All worked harmoniously together—which was the only method by which complete success could be attained.

CITY AND GUILDS OF LONDON INSTITUTE.

Prizes Awarded by the Society of British Gas Industries.

The following is a list of the winners of the prizes given by the Society of British Gas Industries in the City and Guilds of London Institute's recent examinations in Gas-Works Practice, Gas Supply Practice, and Gas Fitting.

MINOR COURSE IN GAS-WORKS PRACTICE.

1st prize, £5 5s., James Henry Browne, examined at Torquay.
2nd ,, £2 2s., Richard Leslie Jones, examined at Colchester.

MINOR COURSE IN GAS SUPPLY PRACTICE.

1st prize, £5 5s., Arthur James Barber, examined at Keswick.
2nd ,, £2 2s., Arthur George Hubbard, examined at Norwich.

FINAL EXAMINATION IN GAS FITTING.

1st prize, £5 5s., William George Biggins, examined at Newport (Mon.).
2nd ,, £2 2s., Arthur William Fowmes, examined at Birmingham.

BISHOP'S STORTFORD GAS COMPANY.

Application Under the Gas Regulation Act.

On Wednesday, Sept. 26, Mr. J. F. RONCA, Director of Gas Administration, attended the offices of the Board of Trade, Great George Street, S.W., to hear an application from the Bishop's Stortford, Harlow, and Epping Gas Company for a Special Order under section 10 of the Gas Regulation Act, to fix the standard price and to make provision in regard to renewal and redemption funds, the purchase of land, and other matters.

Mr. Craig Henderson, K.C., appeared for the Gas Company, while the Hertfordshire County Council, who opposed certain matters, were represented by Mr. H. F. Bidder.

Mr. CRAIG HENDERSON, K.C., dealing with the proposal to form a redemption fund, pointed out the dividing line between capital lost through bad management or wasteful expenditure of capital and capital which had been lost through no fault of the Company. The general practice under gas legislation was that, where it could be proved there had been bad management and waste on the part of the Company, the burden of redeeming that capital fell upon the profits of the Company in such a manner that the consumers should not be injuriously affected. Where, however, it was not the fault of bad management, then the practice was to give permission to build-up a fund out of revenue. On the latter basis he claimed that he had a strong case to present; and it would be contrary to the Board of Trade practice to require a redemption of lost capital out of profits where the loss had not been due to any fault of the Company. The position in the present case was that the Bishop's Stortford Company was authorized in 1904 to manufacture and supply gas within a certain area. In 1910 there was an amalgamation of the Bishop's Stortford Company and other Companies, including the Harlow and Sawbridgeworth Company, the Stansted Gas Company, and the Much Hadham Gas Company. At the time of the amalgamation the share and loan capital of the Company was £120,863, and in 1907 it was £159,186. Between 1911 and 1927 the sale of gas had increased from 101,420,000 c.ft. to 175,572,000 c.ft. The capital expenditure had gone up by something like 31 p.ct. and the sale of gas by 73 p.ct. One of the chief aims of the amalgamation, of course, was to economize in the cost of manufacture; and to do this, the works which had been taken over from the old Companies were shut down. These were at Harlow, Much Hadham, and Stansted. This closing-down of three separate works, as the first step following the amalgamation, represented a considerable amount of money; and the evidence would show that approximately £10,300 represented to-day capital of the Company which was obsolete. It was proposed to set aside the sum of £10,000 for this purpose. The only opponent was the Hertfordshire County Council. As a matter of fact, the undertaking was much more in Essex than in Hertfordshire; but the Essex County Council did not oppose, nor did the Urban District Councils of Bishop's Stortford, Sawbridgeworth, and Epping. It was difficult to gather from the objection lodged what reason the Hertfordshire County Council had for opposing the application for power to establish a renewals fund, because the result, if the Company were successful, would in the end be very beneficial both to the consumers and to the public. On the question of the reduction of the standard price, Mr. Craig Henderson said he did not know whether this was objected to; but if it were it would be very strange, because the proposal now made to reduce the standard price fixed in the Company's Act of 1921, of 2od. per therm to 16d. per therm, was the result of negotiations and an agreement with the Hertfordshire County Council themselves in 1926. As the result of those negotiations, the Company agreed to take the first opportunity of obtaining Parliamentary sanction to this reduction; and the present was the first occasion upon which they had been before the Board of Trade since 1926.

Mr. BIDDER (for the Hertfordshire County Council) said there was no objection to the reduction if this stood by itself, but the position of the County Council was that the other matters in the Order applied for seriously affected the position; and the opinion of the County Council was that the price of 16d. per therm agreed in 1926 should be modified.

Mr. CRAIG HENDERSON replied that the agreement with the County Council in 1926 contained no suggestion that the statutory powers should be restricted in any way; and he suggested that the County Council might reconsider their position in that matter. Dealing with the proposed renewals fund, Counsel said the proposal was that the usual renewal fund clause should be granted to the Company, enabling them to appropriate out of revenue a sum not exceeding 1 p.ct. of the capital for the time expended by the Company for the purposes of the gas undertaking; including premium. This fund was, of course, only to meet expenses requisite for the maintenance and renewal of plant and works; but the County Council objected on the ground that the Company already had power to create a special purposes fund which would give them all they required. This, however, was a misconception, because it was renewal of the plant which the Company contemplated making out of the proposed new fund, and the Company would deface in the near future the heavy demand for renewals. It was anticipated that in the next five years there would be required for renewals of plant the sum of £10,700, and in addition a further sum of £12,000 for mains over a period of fifteen years. Other renewals would aggregate more than £7000; and all this work was essential in regard to the renewal of plant in the ordinary course of the Company's business, the existing plant having spent its useful life. At present the Company had power to spend out of revenue in respect of each year, but the object was to level up that charge over a period of years. As regards additional land, there was no opposition, and the proposal was to acquire certain land in respect of which agreements had been come to with the land owners in the vicinity as to which portion should be used for manufacture and which portion only for storage. The Special Order also proposed to give the Company power to purchase land by agreement to any extent; and at the moment the Company proposed to purchase some ten acres, which it was thought was a wise decision, because this was not a Gas Company with a concentrated area similar to a town. The district was 24 miles long and 12 miles broad, and there were four different works in operation at Bishop's Stortford, Epping, Ongar, and Newport. All these were developing districts, and extension of the individual works would at some future time be necessary. Owing to the present building extension going on, there might be encroachment upon the available lands surrounding the works; and the Company might be hampered in the future as regards extension. Therefore they thought it was wise that they should have authority to buy the ten acres in their area, so as to provide for any possible extensions. But they did not ask for any power to manufacture gas on any of those lands.

Mr. *E. L. Burton* (the Chairman of the Company) gave evidence. He pointed out that since the amalgamation the Company had been very energetic in carrying on their work, and had secured economies in manufacture. In regard to the reduction of 2od. to 16d., this was only carrying-out the undertaking which they agreed with the County Council in 1925 and 1926; and then, as they were situated in such a scattered district, they considered that they should be in the proper position to acquire land which might be in the market now and which they would probably require later.

In cross-examination by Mr. Bidder, witness was questioned at some length in regard to the item of depreciation in the balance-sheet, and the Director intimated that he would require documents showing how the capital value of the Companies taken over in 1910 were made out, as set out in a form handed him, and showing that the capital value of Harlow and Sawbridgeworth was £12,245.

Mr. BIDDER said the reason why the County Council called the reduction of price into question was that in their view the proposals prejudicially altered the chance of the reduction of price; and in so far as they did that they felt bound to ask that the standard should not be allowed as high as the figures agreed. If the proposals as regards the redemption fund and maintenance were omitted, they would have nothing whatever to say about the price.

Witness: That is an extraordinary position to take up.

COUNSEL asked whether the Company considered the present price of 1s. 4d. per therm was a low one, all things considered.

Witness expressed the opinion that it was a very modest price, though it was his ambition to see that price reduced from time to time.

COUNSEL: But a good many of your neighbours do better?

Witness: Undoubtedly; and as I have had something to do with them, I know the fortunate position in which they are placed.

COUNSEL pointed out that Watford charged 10d. per therm, and St. Albans 9d.; Barnet 10½d., and Hitchen 11d. Was it the fact that the £1600 a year which it was proposed to apply to the redemption fund would, if applied to a reduction in the price of gas, be equivalent to 2d. per 1000 c.ft.

Witness agreed.

COUNSEL then put it that the proposed contribution to the renewal fund would add another 1½d. per 1000 c.ft., or a total of 0·6d. per therm. He observed that the amount of stock handed over to the existing Company was £1200 in the case of Ongar, whereas the capital issued was only £6000; therefore it appeared that the concern was bought not on the valuation of the assets, but on the consideration of its earning propensities.

Mr. *W. C. Kimpster* (the Engineer and Manager to the Company) produced a list of the various items of renewals. These showed that £11,500 would be required for the Bishop's Stortford Works, £7900 for the Epping Works, and £1500 for the Ongar Works. Within the next twenty years it was contemplated there would have to be an expenditure of £22,700, all of which was necessary to maintain the efficiency of the undertaking. He was of opinion that it would be advisable to have a renewal fund on which to draw for that expenditure, instead of drawing the various sums out of revenue.

COUNSEL queried some of the items, and pointed out that they were exceptional, inasmuch as they only occurred once in a period of years.

Mr. *Edward Thomas Brown* (the Distribution Engineer and District Superintendent) gave evidence in regard to the expenditure necessary upon the distributing mains in the district; and this he found came to a total of £7147, which money, he contended, must be spent within the next twelve to eighteen months. Some of the mains which had to be renewed had been in existence for sixty years, while others had been in operation for 25 to 30 years.

THE CASE FOR THE HERTFORDSHIRE COUNTY COUNCIL.

This concluded the case for the Gas Company, and Mr. Bidder called Mr. W. B. Keen, the County Accountant of Hertfordshire, who contended, in regard to the capital redemption, that it would impose great hardship on the gas consumers if they had to provide the capital for the undertaking. The principle of writing-down capital at the expense of revenue was a new one, and had practically arisen since the war in connection with special war expenditure; and circumstances of a special character were required to treat this writing-down as a revenue expenditure. When costs, rates, and charges of every description were very high, it was undesirable to burden the ratepayers with that extra cost. He did not see the slightest reason for the Company's taking that step of writing-down capital, as the Company had a special purposes fund which was available to meet the extraordinary renewals which might be necessary; and that fund, he contended, would prove adequate for the purpose, even in view of the evidence which had been given as to the big items of renewal needed. Dealing with the question of the price of gas, Mr. Keen said that had there been any proposal similar to that now before them when the agreement was settled, he certainly would

never have recommended the Hertfordshire County Council to accept the 16d. It had been recognized for many years that in the case of statutory companies the practice had been to meet renewals as they came along out of revenue. With regard to limited companies, the practice had been more often the other way—namely, in each year to put aside a sum to represent wear and tear, and out of that sum to meet the renewals as they became due. It was always unsatisfactory from an accountant's point of view to jump from one system to another; and he saw no reason in the present case why there should be a departure from the system the Company had always adopted. If they had to meet repairs and renewals of an abnormal kind, his view was that the special purposes fund was available. He contended that, from the point of view of the consumer, the present case was special because there was no electric light company in competition in regard to the price. He argued that the 1 p.ct. which the Company were already entitled to take for their special purposes fund was as much as should be set aside for that purpose. To put aside more for renewals would be unfairly depriving the consumer of the benefit of the revenue. Under the suggestion of the promoters, the present consumers were asked to find capital out of their ordinary payments to revenue which, it was true, could be represented as yielding interest to future consumers; but it was taking capital out of revenue of the present consumers, and it was not sufficient to say that future consumers would benefit by it.

Mr. Bidder, in addressing the Director, on behalf of the Hertfordshire County Council, said that in regard to renewals, the real issue between them was the amount that should be set aside. Already 1 p.ct. had been allowed to be set aside for that ambiguous purpose, and they objected to more than 1 p.ct. per annum being thus used. He suggested that the simplest solution would be for the Board to make it clear that the special purposes fund could be used for the large items which had been mentioned.

Mr. Craig Henderson, in the course of his remarks, pointed out that, in regard to the capital redemption fund, the opposition had been solely the evidence of Mr. Keen. They submitted that the Board of Trade, in accordance with the principles now well established, and confirmed by the Gas Regulation Act, provided a case for allowing the capital being redeemed, in regard to that which was obsolete, if they were satisfied that it was obsolete, and it could be redeemed by such a fund as was proposed. They did feel that it was inadvisable to continue longer the position in which the profits had to be earned and dividends distributed on a capital for which there were no assets in the existing Company. In regard to the question of the renewals fund, it was by no means clear that the special purposes fund covered the renewals; and he submitted that this was a matter of interpretation. Then again, he was of opinion that they should not consider the individual shareholder's or the individual consumer's respective interest. They should consider the undertaking as a whole, in which both the shareholder and the consumer were concerned; and he submitted that there could be no dispute as to the soundness of the financial policy which created a renewals fund, and that the amount suggested by him was by no means excessive. It was right that an asset which helped to provide the profit should have as a charge against itself, so to speak, something which would provide a fund out of which it could be replaced when its useful life was ended. As regards the price of the gas, he objected to any further reduction, and to the County Council's challenging the figure at which they had arrived. He submitted that no cause had been shown as to why there should be any variation of the standard price from the figure they had brought forward. In conclusion, he asked the Board of Trade to make the necessary Order authorizing the respective funds and fixing the standard price at 16d. as agreed with the Hertfordshire County Council.

The Director will give his decision in due course.

COKE OVEN GAS FOR BURNLEY.

At their meeting this week the Burnley Town Council will be asked by the Gas Committee to confirm an arrangement into which they have provisionally entered with a Company to be formed by the Executors of John Hargreaves, Ltd., of Burnley, and the Altham Colliery Company (1924), Ltd., for the purchase by the Gas Department from the Company of 1½ million c.ft. of coke oven (500 B.Th.U.) gas per day, for a period of ten years, at the price of 8¾d. per 1000 c.ft.; and their proposal to apply for power to borrow £60,000 to meet the capital expenditure necessary to be incurred in connection therewith.

In a report to the Council, the Chairman of the Gas Committee states: The Council will remember that when the new works at Oswald Street were sanctioned, it was stated that the works then authorized were only the first part of a scheme for new gas-making plant, and would not of themselves supply all the gas required by the undertaking. The new works are in operation, and are functioning satisfactorily, but the total yield of gas is not sufficient to enable the Gas Committee to dispense with the use of the Saunder Bank Works during the winter months. The condition of the Saunder Bank Works is extremely unsatisfactory, the cost of producing gas there is high, and the Committee are advised that it will be very difficult, if not impossible, for gas to be produced at those works after the winter of 1928-29. In these circumstances, the Committee have considered the alternatives which were available to them of putting in hand a second unit of plant at the Oswald Street Works, or purchasing coke oven gas. A very careful comparison has been made of the alternatives, and prolonged negotiations have taken place with representatives of the Colliery Companies, with the object of obtaining a cheap supply of coke oven gas. After giving careful consideration to these alternatives, the Gas Committee are unanimously of the opinion that it is preferable to purchase coke oven gas at the price above mentioned and on the conditions set out in the minutes of the Gas Committee. The capital sum of £60,000 referred to will be spent on the laying of a main from the coke oven plant at Altham to the Oswald Street Works, on certain necessary purification plant, and on stand-by water gas plant for use in the event of a breakdown in the supply of coke oven gas.

According to the minutes of a recent meeting of the Gas Committee, the supply is to commence within twelve months from the Corporation obtaining all necessary sanctions, and to continue for a period of ten years certain, and thereafter subject to determination on two years' previous notice given at any time after the eighth year. The Company will be under obligation to supply an additional half-million c.ft. of gas per day, equal in quality to that previously supplied, at any time during the currency of the agreement after the winter of 1933-34, if required so to do by twelve months' previous notice from the Corporation. The Company must offer to the Corporation any additional supplies of coke oven gas which they may have for disposal during the currency of the agreement before negotiating for its sale elsewhere. The Company will store at their works 500 tons of coke and a stack of coal sufficient to enable the Corporation to make for themselves the quantity of gas to be delivered under this agreement over a period of eight weeks, in the event of the Company being unable to carry out their contract in consequence of unavoidable causes. There will be a guarantee that not less than 60 p.ct. of the coal used in the manufacture of the gas sold under this agreement shall be taken from seams within the area of the County Borough of Burnley.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Half-Yearly Meeting.

The Half-Yearly Meeting of the Alliance and Dublin Consumers' Gas Company was held in Dublin on Sept. 26—Mr. Francis J. Dickins, the Chairman, presiding.

The Chairman, in moving the adoption of the report, said it was again his privilege to submit figures showing a gratifying expansion of the Company's business. During the half-year, the sale of gas amounted to 4,948,769 therms, compared with 4,488,085 therms for the corresponding period of the previous year. Extensions had been made to many new housing sites, at one of which provision had been made for nearly 800 houses; and all of these were to be fitted with the latest gas appliances. Altogether 5154 new consumers had been secured. Two large installations well merited comment. In the "Plaza" Restaurant, apparatus capable of catering for 2000 people had been fitted, while at the Mansion House, where entertainments of a public character were carried out, another all-gas kitchen had been completed. There was a growing demand for gas for various industrial purposes; and equipment for baking and confectionery, brazing and vulcanizing, laundry work, &c., had recently been installed. To summarize the actual business done, 12,464 cookers, 2919 fires and radiators, 346 geysers, coppers, and boilers, and 935 ovens, hotplates, &c., had been fitted, representing a total of no less than £55,000. Perhaps the greatest expansion lay with the prepayment department. There were now no fewer than 58,669 slot consumers. The consumption for last year reached the record figure of 941 million c.ft.; the corresponding figure ten years ago being 464 millions.

A commencement had been made with the extension of the office accommodation at Leinster Market, where there would be a staff restaurant and stores. This extra office space would relieve the congestion in the general office. During the half-year the original setting of vertical retorts, and three of the generators of the carburetted water gas plant, had been renewed, and a saving had been effected in the cost of repairs and maintenance of quite £10,000. A thorough examination of the Company's gasholders had been made early this year, and it was gratifying that nothing of a serious nature had been discovered. So, after some minor repairs, they were now in first-class condition.

In connection with tar and its products, the outlook for the future was not so bright, owing to the intense competition from bitumen. With regard to the sulphate of ammonia plant, the price realized per butt of ammoniacal liquor was satisfactory—a result which had been attained by running the plant at its maximum capacity, and then closing it down for at least three months out of the six. With a view to increasing the popularity of coke as a clean, smokeless fuel, they proposed to place on the market shortly at least four different sizes of the material to meet the requirements of both industrial and domestic consumers. For this purpose a screening plant had been ordered.

Turning to the actual figures of the accounts, it would be seen that the net receipts were lower by nearly £17,000, due, in spite of the increased sales, to the reduction in the price for gas of 1d. per therm, or 4¾d. per 1000 c.ft., which came into force at the beginning of this year. However, it was apparent that economies had been effected. Summarizing the financial position, it would be seen that the income was lower by £24,000, though expenditure had fallen only by £15,000, so that the revenue profit was less than in the corresponding period by approximately £9000. Notwithstanding this, however, the balance of net revenue available, after meeting debenture and bank interest, and the bonus granted by the stockholders to the Directors and staff, was sufficient to meet the increased dividend recommended of £7 12s. 6d. p.ct., and to leave the substantial balance of £30,947 to be carried forward—a sum greater by £4300 than that brought forward into the account from the previous period. The balance at the credit of the profit and loss account was greater by £10,000, and the funds had risen by £16,000, while the investments had increased by £25,000.

In conclusion, the Chairman expressed appreciation of the way the chief officials and staff had worked during the six months, and his confidence in the Company's prospects for the future.

Mr. J. F. X. Murphy seconded; and the meeting concluded with a vote of thanks to the Chairman.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

The position does not improve at all. The prospects of obtaining boats are better; but demand for all kinds of coal is exceedingly quiet. Northumberland steams alone appear to be maintaining their position, though this has been bad enough for months past. Durhams of all kinds, on the other hand, have been steadily losing ground during the whole of September, and idle time has been on the increase. There appears to be no demand for coking coals, and the anticipated seasonal inquiry for gas coal has not yet materialized. Prices in some cases have consequently tended to ease, though every effort is being made to maintain them.

Quotations for Wear Special gas makes are 15s. to 15s. 3d. f.o.b.; 14s. 6d. to 14s. 9d. for best qualities; and 13s. to 13s. 3d. for seconds. Durham unscreened coking is 13s. to 13s. 3d., and the same is asked for ordinary bunker qualities. Special bunkers are 13s. 6d. to 13s. 9d. Northumberland steams maintain the fixed minimum prices of 13s. 6d. for best screened sorts downwards. Gas coke is quoted 19s. 6d. to 19s. 9d. f.o.b. for shipment.

YORKSHIRE AND LANCASHIRE.

Gas coals are moving fairly easily under contract, and there are indications that contracts for the immediate future will be at slightly increased prices.

General industrial fuel has not been advanced by reason of the easy position in this market. Washed singles appear to be in fair request, but doubles are rather hanging fire. Coking smalls have maintained recent figures, with furnace coke slightly easier as compared with last week.

The export section reports fairly good business for forward delivery, although the effect of the Doncaster Race holidays is still being felt.

There has been a certain amount of business during the past week in domestic coal, probably occasioned by the advance of 1s. 8d. per ton, although merchants have been able to deliver promptly.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports:

South Yorkshire—Hards, Association, bunkers 20s., export 15s. 6d. to 16s.; screened gas coal, export 15s. 6d. to 16s.; washed trebles, 15s. 6d. to 16s.; washed doubles, 14s. 6d. to 15s.; washed singles, 13s. 6d. to 14s.; washed smalls, bunkers 15s., export 11s.; rough slack, bunkers 14s.; smithy peas, export 16s. 6d. to 17s. 6d. per ton.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 17s. 6d., export 14s. to 15s.; screened gas coal, export 14s. to 15s.; washed trebles, 15s. to 15s. 6d.; washed doubles, 13s. 6d. to 14s.; washed singles, 13s. to 13s. 6d.; washed smalls, bunkers 14s. 6d., export 10s. to 11s.; unwashed trebles, export 14s. 6d.; unwashed doubles, 11s. to 11s. 6d.; rough slack, 8s. 9d. to 9s. 3d.; coking smalls, 8s. 6d. to 9s. 6d. per ton.

Derbyshire and Nottinghamshire—Top hards, bunkers, 19s. 9d. to 20s., export 15s. to 16s.; cobbles, export 15s. to 16s.; washed trebles, 15s. 6d. to 16s.; washed doubles, 14s.; washed singles, 13s. 6d.; washed smalls, bunkers 14s. 6d. to 15s., export 11s.; unwashed doubles, export 11s. 6d. to 12s. 6d.; rough slack, bunkers 13s. 3d. to 13s. 9d., export 9s. to 10s. per ton.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 17s. 6d. to 18s. 6d., export 12s. to 13s. 3d.; gas coke, export 20s. to 23s.; furnace coke, 19s. to 19s. 6d.; washed steams, Goole 16s. to 16s. 6d., Hull (West Yorks.) 17s. 9d., Hull (South Yorks.) 18s. 3d. to 18s. 6d. per ton.

MIDLANDS.

There is some further increase of activity in the market. The least satisfactory feature of it is that it owes little to the industrial branch. This remains so unresponsive that improved prices in some descriptions of house coal have no reflection in steams and other classes of manufacturing fuel.

Nearly all the pits are experiencing the stimulus in some degree. Those which purchase high-grade coals for the domestic grate are in a number of instances unable to keep pace with their orders, as there are not the stocks either at pithead or on rail or wharf to draw upon. Many collieries have notified higher prices for October. The seasonal call from the private consumer has not involved any stringency in the lower grades such as are used indifferently for the yard trade or for industrial purposes.

The increased output of slack is being absorbed for the most part by the larger consumption for heating systems. Public utility undertakings are pretty adequately covered. Gas engineers have already made provision for the augmentation of the lighting and domestic heating load, and until quite recently have been asking for retardation rather than acceleration of delivery in districts where the industrial trade is a considerable factor.

For the best grades of house coal the prices quoted are generally from 2s. to 3s. in advance of those ruling at the end of August. In exceptional cases the difference is greater.

Leamington Priors Gas Company.—The 127th ordinary general meeting of the shareholders of the Leamington Priors Gas Company was held at the works on Monday, Sept. 24—Dr. H. Mason, J.P., presiding. The Chairman, in moving the adoption of the report, said the reduction in revenue had been due almost entirely to the lower price of gas. Larger quantities of tar had been used for road treatment, and the general efficiency of the works had been well maintained. The new retort house was in an advanced state of construction and, when complete, a larger quantity of gas would be obtained from the coal, and a further reduction in the price of gas might be possible. The adoption of the report, recommending the payment of the usual dividends, was seconded by Dr. Haynes and carried; and the meeting concluded with a vote of thanks to the Directors and staff, proposed by Mr. E. E. Southorn, and seconded by Mr. Gameson.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Oct.* 1.

The market for tar products continues quiet, and current values are as follows:

Pitch, about 45s. per ton.
Creosote, about 7½d. per gallon.
Pure benzole, about 1s. 8d. per gallon.
Solvent naphtha, 95/160, 1s. 5d. to 1s. 6d. per gallon.
Pure toluole, about 2s. per gallon.
Pyridine, about 5s. per gallon.

Tar Products in the Provinces.

Oct. 1.

There is little of interest in the market for tar products.

Pitch is rather easier, as business is reported to have been done on the Continent at 43s. 6d.

Water-white products are firm, and there continues to be a belief that a rise in the price of petrol will take place shortly.

Benzole is decidedly scarce.

Solvent naphtha is steady, and there is quite a good inquiry for same for delivery to the end of the year. Prices remain unchanged.

Heavy naphtha is quiet, and there is not very much demand.

Toluole is steady.

Creosote is quiet, and the Home Market is a little easier.

Crude carbolic is steadier at the lower prices reported last week.

Cresylic is still quiet, and business is difficult to negotiate.

Naphthalene is steady, and a fair amount of business has recently been transacted.

The average prices of gas-works products during the week were: Gas-works tar, 31s. 6d. to 36s. 6d. Pitch—East Coast, 42s. 6d. to 45s. f.o.b. West Coast—Manchester, 37s. 6d. to 38s. 6d.; Liverpool, 39s. 6d. to 40s. 6d.; Clyde, 39s. 6d. to 40s. 6d. Toluole, naked, North, 1s. 5d. to 1s. 6d. nominal. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 1½d. to 1s. 2d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid, 5⅝d. to 6d.; salty, 5⅝d. to 5⅞d.; Scotland, 5⅝d. to 5¾d. Heavy oils, in bulk, North, 8¼d. to 8½d. Carbolic acid, 60 p.ct., 1s. 11d. to 2s. prompt. Naphthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.		s. d.	
Crude benzole . . .	0 10½	to	0 11	per gallon at works
Motor ,, . . .	1 4½	,, 1 5	,,	,, ,,
90 p.ct. ,, . . .	1 7	,, 1 8	,,	,, ,,
Pure ,, . . .	1 10	,, 1 11	,,	,, ,,

TRADE NOTES.

Gas Lighting Glassware.

Lighting Trades, Ltd., have published a new catalogue of gas-lighting glassware. Their latest designs of ornamental globes and shades, some of which are beautifully illustrated in colour, are most fascinating.

Art in Publicity.

A most attractive booklet on gas fires has been published by the Davis Gas Stove Company, Ltd. It contains about forty pages of illustrations of all their latest designs, and there is a foreword on the health and ventilation value of gas fires.

Conveyor Belts and Bucket Elevators.

A practical study of innumerable belt transporter plants has afforded experience and taught lessons which form the substance of an unusual booklet published by Messrs. Ira Stephens, Ltd., Whitelands Leather Works, Ashton-under-Lyne. The suggestions and hints dealing with the care and maintenance of conveyor belts should prove of great value, and should serve as a guide in the installation of new ones. At the end of the booklet are several photographic reproductions which suggest the variety of uses to which conveyor belts can be put. A supplement is also included which deals with the kindred subject of bucket elevators. We heartily commend this interesting publication to our readers.

Cheaper Gas at Luton.—Interesting facts regarding the position of the Luton Gas Company were brought out at the half-yearly meeting on Sept. 25, when Mr. F. W. Plummer presided. Presenting the Directors' report, the Chairman stated that the increase in total sales amounted to 205,000 c.ft., or 1000 therms, and there was a satisfactory balance to the credit of the revenue account of £11,572, compared with £7050 on June 30, 1927. The payment of the following dividends, less income-tax, was recommended: 2 p.ct. on the "B" preference shares; 2½ p.ct. on the "C" preference shares; £8 5s. p.ct. on the "A" ordinary shares; £6 15s. p.ct. on the "D" ordinary shares; and £4 2s. 6d. p.ct. on the "F" ordinary shares. There would be an increase in the carry-forward of £3000. In view of the successful results of the half-year's working, the Directors had resolved to reduce the price of gas, as from the readings of the meters at Michaelmas, to 7⅞d. per therm, or 3s. 2·22d. per 1000 c.ft.—a reduction of 2·94d. per 1000 c.ft. Mr. Plummer referred to the work of the Manager and staff, and said he regarded the results achieved as a proof of their efficiency. Mr. W. Phillips (General Manager), replying, paid a tribute to his staff generally, specially mentioning Mr. Noel Smith, the Outside Superintendent; Mr. Sole, Accountant and Assistant Secretary; Mr. Simpson, Chief of the Technical Staff; and Mr. Wright, the Works Superintendent.

Cheaper Gas at Northwich.—The Northwich Gas Company have announced a reduction in the price of gas of 3d. per 1000 c.ft. for the December quarter.

"The Cleaning of Coal."—Messrs. Chapman & Hall have just published, at 42s. net, a 680-page volume on this subject by Dr. W. R. Chapman and R. A. Mott, M.Sc., F.I.C. The book is profusely illustrated, and there is an introduction by Prof. R. V. Wheeler.

Lower Charges at Poulton.—For the second time in a year the price of gas at Poulton-le-Fylde is to be reduced, to take effect on Sept. 20. The current price of 1s. 1d. per therm, which, a year ago, was 1s. 4d. per therm, will be lowered to 1s. A similar reduction will be made on gas supplied to Carleton and Hardhorn.

Lower Charges at Plymouth.—The Plymouth Gas Company announce that as from the meter readings at Michaelmas the price of gas will be reduced by a halfpenny per therm (2¼d. per 1000 c.ft.). This will make the charge 6d. per therm (2s. 3d. per 1000 c.ft.) for ordinary consumers, and 5·4d. per therm (2s. 0·3d. per 1000 c.ft.) for engine consumers. There will be a similar reduction for Plympton and the other outlying districts.

Institute of Fuel.—The opening meeting of the winter session of the Institute will be held at the Chemical Society's rooms, Burlington House, Piccadilly, W.C. 1, on Wednesday, Oct. 10, when a paper on "Automatic Combustion Control of Liquid, Solid, and Gaseous Fuels for All Purposes" will be read by Mr. T. A. Peebles, A.S.M.E., Vice-President of the Hagan Corporation, Pittsburgh. The meeting will commence at 6 p.m., and Mr. John Bruce (Member of Council) will preside.

Coke Oven Gas for Accrington.—Coke oven gas will shortly be available to customers of the Accrington District Gas Board, who have entered into an arrangement with the Altham Colliery Company to take gas from the ovens at Altham. The work of laying the main, and making the necessary alterations to the purifiers and the station meters has been proceeding. The General Manager (Mr. A. J. Harrison) told the Board, on Sept. 27, that he expected the ovens to be fired almost immediately, in which event a full supply should be available before the Board met again.

Explosion in Piccadilly Circus.—While excavations were in progress on a subway for the new Piccadilly Circus Tube Station on Thursday last, a workman put his pneumatic drill through a high-pressure gas main. Shortly afterwards—before there was time to plug the hole or turn off the gas—an explosion occurred which resulted in slight burns to eight men, who were taken to the Charing Cross Hospital, but were not detained. The explosion took place beneath the refuge in the middle of the Circus, and at one point the roadway and pavement were damaged. The fire brigade were summoned as a precaution, and the gas was immediately cut off.

Meter Testing in Edinburgh.—Mr. William Gordon (Official Inspector), in his report for the year ended May 15, states that the number of meters tested and examined was 92,875, of which 789 were wet; and the fees received amounted to £5179. This was a decrease of 3220 in the number of meters and £164 in fees as compared with the previous year, but an increase of 7519 meters and £461 in fees on the year ended May 15, 1926. There are now eight district gas meter testing stations, under the jurisdiction of the Magistrates. A continued increase in the distribution by prepayment meters is a testimony to the popularity of this type of measuring instrument among consumers of gas. The high-capacity meter has, during the past twelve months, been submitted in large numbers for inspection and verification. This type of meter will deliver and accurately register more than double the capacity of that of an ordinary type, though the outer case is of practically the same dimensions as those of a standard meter. Of the meters tested in the past year, 1513 were rejected as incorrect.

Half-Yearly Meeting of the Guildford Gas Company.—At the half-yearly meeting of the Guildford Gas Light and Coke Company on Sept. 20, with Mr. F. F. Smallpeice in the chair, an increase of 7·6 p.ct. in the sale of gas, compared with the corresponding period last year, was reported. The balance standing at the credit of the profit and loss account was £17,735, and the Directors recommended a dividend of 5 p.ct. on the preference stock and 7½ p.ct. on the consolidated ordinary stock, both less income-tax. This would leave £12,161 to be carried forward to the next account. The Chairman, in moving the adoption of the report, pointed out that the Company were sharing the prosperity which the gas industry was enjoying throughout the country; and as long as they continued to keep prices low and give their consumers the best apparatus, their prosperity would continue. Mr. Stephens seconded the motion, which was carried unanimously. The meeting concluded with a vote of thanks to the Chairman, Directors, and staff, on the motion of Mr. W. Williamson, seconded by Mr. A. E. Edwin.

Gas Equipment in Flats.—One of the largest owners of several blocks of flats in London is doing the right thing. The flats were built some thirty years ago, and at that time represented the last word in comfort, judged by pre-war standards. During the past few years, however, many improvements have taken place in domestic architecture and equipment, and the progressive management of the property have already started on the sound policy of remodelling and re-equipping their flats as leases expire or when existing tenants express their willingness to allow improvements to be incorporated. Among the improvements are tiled kitchens with recesses for all-enamel gas cookers, panelled bathrooms, a gas-operated refrigerator as standard equipment, supply pipes for gas fires to every fireplace, a constant supply of hot water, and one hot water radiator in every flat. So attractive are these improvements, which can be seen in a model flat which is being kept vacant, that many of the existing tenants have asked for all improvements to be incorporated at once in their flats and for the rentals to be increased to cover the capital expenditure involved. Full particulars and illustrations of the equipment provided are contained in the current issue (No. 174) of "A Thousand-and-One Uses for Gas," published by the British Commercial Gas Association.

Fuel Industries was registered as a private Company on Sept. 27, with a nominal capital of £31,250 (25,000 preference shares of £1, and 25,000 ordinary of 5s.), to carry on the business of producers and converters of raw coal, distillers of shale, &c. Subscribers: C. G. Cave and A. W. Slade. Solicitors: Mayo Elder & Co., 10, Drapers' Gardens, E.C.

Increased Gas Sales at Truro.—At the annual meeting of the Truro Gas Company—Mr. J. Rogers, the Chairman, presiding—it was reported that the quantity of gas sold showed an increase of more than 5 million c.ft. on the figures of 1926, and that since the close of the financial year on June 30 the output had exceeded that of the corresponding period last year by over half-a-million c.ft. There was a credit balance of £4166, and the Directors recommended dividends of 5 p.ct. on the preference stock and 5½ p.ct. on ordinary stock (both less income-tax), after payment of which £2396 remained to be carried to the next account. In moving the adoption of the report and accounts the Chairman referred to the increasing prosperity of the Company, pointing out that, in spite of the recent introduction of electricity to the town, the consumers of gas were steadily increasing, and there was an ever-growing demand for appliances for cooking, heating, and power. The motion was seconded by Mr. W. S. Sitwell, and carried unanimously. A vote of thanks was accorded to the Chairman, Directors, Engineer, and staff for their efficient management during the year, on the motion of Mr. J. R. Paull, seconded by Mr. W. E. Grenfell.

Gas Supply at Helston.—The Mayor of Helston (Alderman J. B. Martin), who is Chairman of the Gas Committee, gave an emphatic denial at Wednesday's meeting of the Borough Council to statements made in the town that the gas undertaking was a charge on the rates. The accounts, he said, were absolutely independent. A councillor said that tradesmen were complaining of the poor quality of the gas, and the Mayor replied that at the present time it was impossible to give sufficient pressure to ensure a full and satisfactory supply to every customer, but the position would be remedied as soon as the new gasholder was operating. The Gas Manager (Mr. W. Maclean) said he feared the supply could not be made entirely satisfactory until the new holder was installed. The Council resolved to negotiate loans of £3500 and £750 to meet the expenditure in connection with the new holder, and for the purchase of gas showrooms in Church Street. Replying to Mr. W. J. Rogers, who said the purchase of coal seaborne to Porthleven would save £200 a year, the Mayor said that the Committee had entered into a contract for the purchase of 600 tons of coal seaborne to Hayle, and that would last them until about Christmas. When the next consignment was being ordered, Mr. Rogers' suggestion would be considered.

Satisfactory Progress at Lewes.—At the half-yearly meeting of the Lewes Gas Company on Sept. 26, with Mr. W. E. Nicholson in the chair, it was stated that the balance of net revenue was £2691, there being an increase in the profits of £362 compared with the previous year. The Directors recommended a dividend of 5 p.ct. on the original capital stock, and £3 10s. p.ct. on the additional capital stock, which, less income-tax, would amount to £1607. The Chairman observed that the accounts were very satisfactory. The recently installed vertical retorts, using Durham unscreened coal, were working extremely well, and the Company had expended considerably less in the purchase of coal and, at the same time, had made more gas. This installation had elicited great interest, and a short time ago the works were visited by a deputation from Stavangar, and representatives of the Bergen gas undertaking, who expressed themselves as being favourably impressed with all they saw. The dividends were declared on the motion of Alderman Crisp, who said the Directors were to be commended for the way they had carried out their work. Mr. A. W. Oke proposed a vote of thanks to the Secretary (Mr. H. J. Hillman), the Manager (Mr. J. E. Hammond), and the staff, and associated Mr. C. F. Botley (the Consulting Engineer) with the vote; and the meeting concluded with a vote of thanks to the Chairman.

On Oct. 16 Mr. W. M. Mason, Manager of the British Commercial Gas Association, is to address the Publicity Club of Bradford, on "Industry United for Publicity." The Hon. Secretary of the Club is Mr. H. E. Wilde, of the Bradford Gas Department Showrooms, who is also Hon. Secretary of the West Yorkshire Gas Salesmen's Circle, and Hon. Treasurer of the Yorkshire Junior Gas Association.

The Town Clerk of Rotherham has reported to the Gas-Works Committee that he had received a notice from Messrs. John Brown & Co. that owing to the cessation of work at the Rotherham Main Colliery they would not be able to supply coke oven gas after Oct. 10. The Gas Engineer has submitted a report in connection with a stand-by gas plant at an estimated cost of £10,500. Tenders are to be invited, and the Town Clerk has been instructed to apply to the Ministry of Health for sanction to borrow the money to cover the cost.

At the Birmingham Police Court on Sept. 20, Richard Warne, a gas meter inspector, of 32, Oliver Street, Nechells, who for twenty years has been a Corporation employee, was sent to prison for three months, with hard labour, for stealing a large variety of goods from firms in the Birmingham jewellery quarters, whose premises he had been in the habit of visiting in the course of his round. He pleaded guilty, and his Counsel, Mr. Churchill, suggested it was a genuine case of kleptomania. Detective-Sergeant Davies said that on Sept. 11 a porter of Messrs. Joseph Glosters, in Hickley Hill, concealed himself in the cellar, and saw Warne come down to read the meter. He also saw him take a silver matchbox and an electro-plate cigarette case from a bench. In the cellar at his home there was found a great accumulation of goods, which included many watches, cheap jewellery, brass tools, tailors' shears, and many cigarette cases.

STOCK MARKET REPORT.

CHEERFUL conditions prevailed on the Stock Exchange last week. The gilt-edged market was firm, though the business done was less comparatively than in the other markets. Speculative Industrials kept up their reputation; while Oils and the Tin section competed with them in popularity.

The Gas Market was more animated than usual. A larger volume of business was done, and there were some noticeable increases in the quotations. Strong support was given to Primitiva ordinary, which was marked up 3s. 3d. to 26s. 6d.-28s. 6d. The high price indicates that the supporters of these shares are confident of a substantial dividend for the current year; but in view of the conservative policy hitherto displayed by the present Board, this optimism seems hardly justified. It will be seen by the Table that there was a number of other improvements in prices, the principal of which were rises of 3 and 2 points in the Portsmouth 5 p.c. and 4 p.c. stocks respectively.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Sept. 28.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a.	% p.a.				
171,978	Stk.	Aug 30	5	5	Aldershot 5 p.c. max. C.	72—77	..	..
412,992	,,	,,	4	4	Do. 4 p.c. Pref.	68—71	..	..
1,551,868	,,	Sept. 27	7	7	Alliance & Dublin Ord.	95—95*	—3	95½—99
374,000	,,	July 12	4	4	Do. 4 p.c. Deb.	58—66	..	..
522,654	,,	Aug. 30	7	7	Barnet Ord. 7 p.c.	109—112	..	..
300,000	1	Apl 26	1/7½	1/7½	Bombay, Ltd.	21/—23/-	..	..
170,000	10	Aug 30	8½	8½	Bournemouth 5 p.c.	12½—13½	..	..
500,050	10	,,	7	7	Do. B 7 p.c.	12½—12¾	..	12⅝
375,000	10	,,	6	6	Do. Pref. 6 p.c.	10½—11⅛	..	11⅛
50,000	Stk.	July 12	3	3	Do. 3 p.c. Deb.	56—59	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	75—78	..	..
357,900	,,	Aug. 30	7½	7½	Brighton & Hove 6 p.c. Con.	114—117	..	..
341,880	,,	,,	6¾	6¾	Do. 5 p.c. Con.	101—104	..	..
1,927,500	,,	July 26	5	5	Bristol 5 p.c. max.	90½—91½a	..	..
855,000	,,	Sept. 27	7	8	British Ord.	111—114*	—3	112½—116
100,000	,,	June 28	7	7	Do. 7 p.c. Pref.	114—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	74—77	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	95—98	..	..
160,000	10	May 24	8	8	Cape Town, Ltd.	8—9	..	..
100,000	10	Apl. 26	4½	4½	Do. 4½ p.c. Pref.	6½—7½	..	..
150,000	Stk.	June 28	4½	4½	Do. 4½ p.c. Deb.	78—78	..	..
626,880	,,	July 26	6	6	Cardiff Con. Ord.	96—99	..	..
287,880	,,	June 28	7½	7½	Do. 7½ p.c. Red. Deb.	100—103	..	..
157,150	,,	Aug. 16	6½	5	Chester 5 p.c. Ord.	88—93b	..	..
72,185	1	Apl. 26	†2/-	†2/-	Colombo Ltd. Ord.	35/—38/-	..	..
24,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	21/—23/-	..	..
375,402	1	Apl. 12	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	23/—25/-	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	21/—23/-	..	..
2,078,280	Stk.	July 26	7	5	Commercial Ord.	98—101	+1	98½—99½
475,000	,,	June 14	3	3	Do 3 p.c. Deb.	57—60	..	..
800,000	,,	Sept. 27	†1	†1	Continental Union, Ltd.	30—35*	..	32—32½
200,000	,,	,,	7	7	Do. 7 p.c. Pref.	90—95*	—2	94½
787,560	,,	Aug. 16	7	7	Croydon sliding scale	109—112	+1	111—111½
408,100	,,	,,	5	5	Do. max. div.	84—87	+1	85½—86
498,270	,,	Aug. 16	10	7	Derby Con.	115—120e	..	..
55,000	,,	June 28	4	4	Do. Deb.	71—78e	..	..
209,000	,,	Aug. 30	5	5	East Hull Ord. 5 p.c.	75—78	..	..
50,000	,,	June 28	5	5	Eastbourne 5 p.c. Deb.	94—97	..	..
1,002,180	10	Sept. 13	16	†4	European, Ltd.	8—9*	..	8⅞—8¾
12,709,480	Stk.	July 26	5/1/4	5½	Gas Light & Coke 4 p.c. Ord.	19/4½—19/10½f	..	19/4½—19/9
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	62—64	..	63½—64
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	77—80	..	78—78½
5,802,620	,,	June 14	3	3	Do. 3 p.c. Con. Deb.	61—63	..	62
181,315	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	103—106	..	..
1,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	99—101	..	99½—101½
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Aug. 30	6¾	7	Hastings & St L. 5 p.c. Conv	88—93	..	..
258,740	,,	,,	5⅔	5⅔	Do. 3½ p.c. Conv.	71—75	..	..
70,000	10	Apl. 26	†10	†10	Hongkong & China, Ltd.	13½—14½	..	..
178,200	Stk.	Aug. 30	5	5½	Hornsey Con. 3½ p.c.	85—87	..	..
1,976,000	,,	May 24	10	10	Imperial Continental Cap.	171—176	..	173—174½
238,180	,,	Aug. 16	3½	3½	Do. 3½ p.c. Red. Deb.	67—69	..	..
235,242	,,	Aug. 16	7	7½	Lea Bridge 5 p.c. Ord.	98—101	..	..
2,145,907	,,	Aug. 16	5½	5½	Liverpool 5 p.c. Ord.	90—91b	..	..
600,000	,,	Sept. 27	7	7	Do. 7 p.c. Red. Pref.	101—103b*	—2½	..
165,786	,,	Aug. 16	8	9	Maidstone 5 p.c. Cap.	112—117	..	..
63,480	,,	June 14	3	3	Do. 3 p.c. Deb.	55—58	..	..
75,000	5	June 14	†8	†8	Malta & Mediterranean	5½—6¾	..	..
541,920	Stk.	May 24	†5	†7	Montevideo, Ltd.	96—98	+1	96—96½
3,061,815	,,	Aug. 16	5	5	Newcastle & Gateshead Con.	16/3—16/9df	+/-/1½	..
360,929	,,	,,	4	4	Do. 4 p.c. Pref.	72½—73½d	—½	..
691,705	,,	June 28	8½	8½	Do. 8½ p.c. Deb.	69½—70½	..	..
131,780	,,	Aug 30	6/18/0	7/1/0	North Middlesex 6 p.c. Con.	96—99	..	..
800,000	,,	Apl. 26	9	7	Oriental, Ltd.	115—118	..	116½—116¾
188,130	,,	June 28	7½	7½	Plym'th & Ston'house 5 p.c.	107—112	..	..
414,500	,,	Aug. 30	7½	7½	Portsm'th Con. Stk. 4p.c. Std	101—104	+2	..
236,782	,,	,,	5	5	Do. 5 p.c. max	79 82	+3	81½
2,334,464	1	—	—	—	Primitiva Ord.	26/6—28/6	+3/3	24/—27/7½
244,500	100	June 1	4	4	Do. 4 p.c. Red. Deb.	91—94	..	..
695,000	Stk.	July 26	4	4	Do. 4 p.c. Red. Deb 1911	78—80	..	79½—80
416,845	,,	June 28	4	4	Do. 4 p.c. Cons. Deb.	78—80	..	..
150,000	10	Sept. 27	6	6	San Paulo 6 p.c. Pref.	8—8½*	—½	..
270,000	Stk.	Aug. 30	6	6½	Sheffield A	103½—104½*	..	..
419,968	,,	,,	6	6½	Do. B	103½—104½*	..	..
1,047,000	,,	,,	6	6½	Do. C	103½—104½*	..	..
90,000	10	June 14	†3	†4	South African	5—6	..	..
6,609,845	Stk.	July 26	7½	5	South Met. Ord.	106 108	..	106½—105½
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	110—113	..	111½—112½
1,895,445	,,	July 12	3	3	Do. 3 p.c. Deb.	59—61	..	59½
734,000	,,	Sept 13	6½	6½	Do. 6½ p.c. Red. Db.	99—101*	..	..
91,500	,,	Aug. 16	8½	8½	South Shields Con.	108—110d	..	..
1 343,795	,,	July 26	6½	6½	South Suburban Ord. 5 p.c	106—109	+1	108½
868,837	,,	June 28	5	5	Do. 5 p.c. Deb	97 100	..	..
647,740	,,	Aug. 30	5	5	South'mpton Ord. 5 p.c. max	77—79	..	..
131,275	,,	June 28	4	4	Do. 4 p.c. Deb	72—75	..	..
350,000	,,	Aug. 30	7	7	Swansea 7 p.c. Red. Pref.	100—102	+1½	..
300,000	,,	June 28	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	+½	100½—101½
120,000	,,	July 26	7½	8	Tottenham District A 5 p.c	117—122	..	..
882,275	,,	,,	6½	6½	Do. B 3½ p.c.	49—102	..	100½—101
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	96—99	..	..
181,355	,,	June 14	4	4	Do. 4 p.c. Deb.	76—79	..	..
					Uxbridge, Maidenhead, &			
989,094	,,	Aug. 30	6⅞	6⅞	Wycombe 5 p.c.	90—95	+1	92—94
88,830	,,	,,	5	5	Do. 5 p.c. pref.	87—92	+1	91½—92
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	July 12	8½	8½	Wandsworth A 5 p.c.	126—129	..	..
355,686	,,	,,	7	7½	Do. B 8½ p.c.	108—118	..	..
492,535	,,	,,	5/19/0	6½	Do. C and New	96—101	..	99
362,000	,,	,,	6⅔	6⅔	Do. Wimbledon 5 p.c.	104—109	..	106½—107
92,000	,,	,,	7½	7½	Do. Epsom 5 p.c.	110—115	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref	88—91	..	..
85,416	,,	June 28	8	8	Do. 8 p.c. Deb.	86—89	..	89
284,742	,,	,,	4	4	Do. 4 p.c. Deb.	75—78	..	..
207,500	,,	,,	5	5	Do. 5 p.c. Deb.	98—100	..	99½

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle. e.—Sheffield. f.—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡ For year.

The following transactions were recorded during the week:

On Monday, Commercial 98½, Continental Union 7 p.ct. preference 94½, Croydon maximum dividend 85⅝, 86, European 83⅜, Gas Light and Coke 19s. 4½d., 19s. 6d., 19s. 7½d., 19s. 8½d., 19s. 9d., 3½ p.ct. maximum 64, 4 p.ct. preference 78½, Imperial Continental 173, Montevideo 96, Primitiva 24s. 1½d., 24s. 3d., 24s. 4½d., 24s. 6d., South Metropolitan 107, 107¾, 108, 6 p.ct. preference 112½, South Suburban 5 p.ct. 108½. Supplementary prices, Danish 8, Gas Light and Coke 5 p.ct. debenture 1952-57 101¼, South Suburban 7 p.ct. debenture 101.

On Tuesdty, Alliance and Dublin 99, Bristol 5 p.ct. 90, Commercial 98⅜, Croydon sliding-scale 111½, Gas Light and Coke 19s. 6d., 19s. 7½d., 19s. 8½d., 19s. 9d., 3½ p.ct. 63¾, 3 p.ct. debenture 62, Imperial Continental 173, 174, Montevideo 96, 96½, Ottoman 1s. 3d., Primitiva 24s., 24s. 1½d., 24s. 4½d., 24s. 6d., South Metropolitan 107¾, Swansea 6½ p.ct. debenture 100½, Tottenham "B" 100½, 101, Wandsworth 3 p.ct. debenture 59. Supplementary prices, Croydon 5 p.ct. debenture 97, Gas Light and Coke 5 p.ct. debenture 1952-57 101¼, Liverpool 5 p.ct. 90½.

On Wednesday, Alliance and Dublin 97, Gas Light and Coke 19s. 6d., 19s. 8½d., 19s. 9d., Montevideo 96, 96½, Newcastle and Gateshead 4 p.ct. preference 72½, Portsmouth 5 p.ct. maximum 81½, Primitiva 24s. 4½d., 24s. 6d., 24s. 7½d., 24s. 9d., 24s. 10½d., South Metropolitan 107½, 108, Swansea 6½ p.ct. debenture 101½, Uxbridge 5 p.ct. 93, 94, Wandsworth 5 p.ct. debenture 99½. Supplementary prices, Croydon 5 p.ct. debenture 97½, Gas Light and Coke 5 p.ct. debenture 101¼, Newport (Mon.) 5 p.ct. maximum 78, 78½, South Suburban 7 p.ct. debenture 101½.

On Thursday, Alliance and Dublin 96½, 97 *ex* div., Bournemouth "B" 12⅝, British 112½, 116 *ex* div., Cambridge University 5 p.ct. debenture 92½, 93⅜, Commercial 99½, Gas Light and Coke 19s. 6d., 19s. 8½d., 19s. 9d., 3½ p.ct. maximum 63¾, 5 p.ct. debenture 101½, Imperial Continental 173, 173½, 174½, 174¾, Oriental 116½, Primitiva 24s. 6d., 25s., 25s. 3d., 25s. 6d., 25s. 9d., South Suburban 5 p.ct. 108½, Tottenham "B" 101, Wandsworth new 99. Supplementary prices, Danish 8, 8½, Gas Light and Coke 5 p.ct. debenture 1952-57 101¼, Metropolitan (of Melbourne) 9½, 9⅝.

On Friday, Alliance and Dublin 96½, Bournemouth 6 p.ct. preference 11½, Continental Union 32, 32½, Croydon 111, European 8⅝, Gas Light and Coke 19s. 6d., 19s. 7½d., 19s. 8½d., 19s. 9d., 4 p.ct. preference 78, 5 p.ct. debenture 99⅜, Imperial Continental 173½, 174, 174½, Oriental 116⅜, Primitiva 26s., 26s. 6d., 26s. 9d., 27s., 27s. 1½d., 27s. 3d., 27s. 4½d., 27s. 6d., 27s. 7½d., 4 p.ct. debenture, 1911, 70½, 80, South Metropolitan 106½, 107¾, 108½, 6 p.ct. preference 111½, 112, 3 p.ct. debenture 59½, Tottenham "B" 101, Uxbridge, Maidenhead, 5 p.ct. 92, 5 p.ct. preference 91½, 92, Wandsworth, Wimbledon 5 p.ct. 106½, 107. Supplementary prices, Eastbourne 3½ p.ct. "B" 106, Gas Light and Coke 5 p.ct. debenture 1952-57 101¼, Watford "B" 99, 99½.

Loanable funds were plentiful in Lombard Street at the end of the week, and the rate for both old and new loans, after 3 p.ct. had been charged, declined to 2½ p.ct., balances being practically unlendable. There was a rise in the average rate at which Treasury Bills were allotted of nearly 3s. 6d. p.ct. to £4 4s. 8·74d. p.ct., which rate was slightly below the general expectations. Discount quotations, however, remained unaltered.

In the Foreign Exchange Market, the New York rate was firm at 4.85-⅝, but the Berlin rate rose to 20.35. Dutch florins were lower at 12.08⅛⅝: French francs were slightly cheaper at 124.05¼: Italian lire were lower at 92.77½: and pesetas and Belgas remained at 29.43½ and 34.89½ respectively.

Silver declined on Continental sales to 26 7/16d. per oz: and with no Gold available, the price remained at 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21, 1927. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2⅝ p.ct. at notice.

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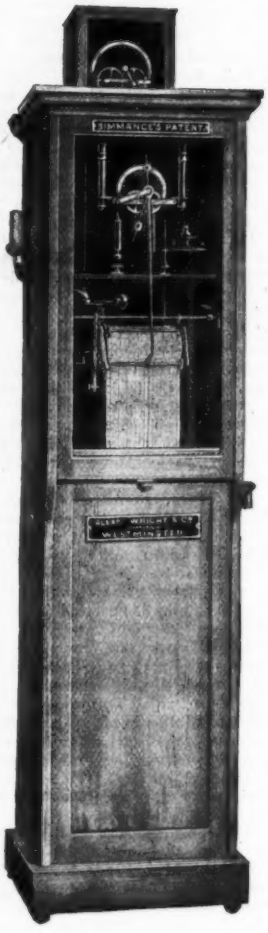

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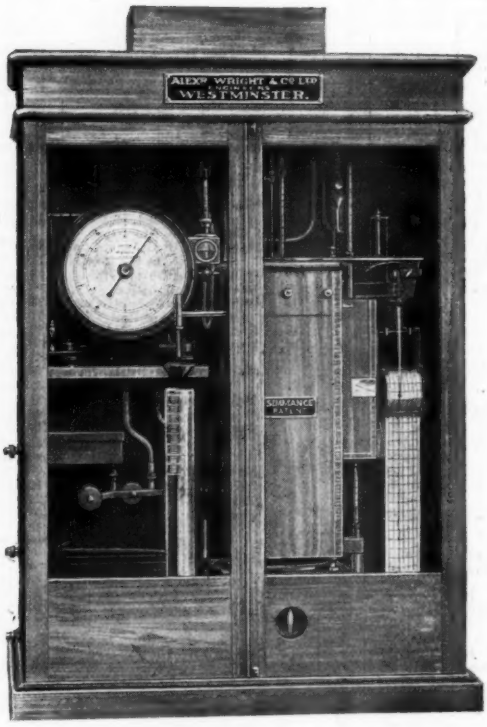

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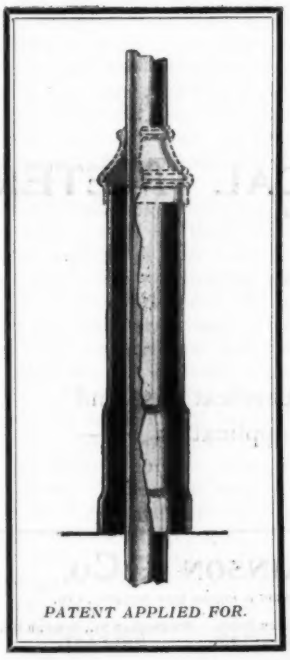

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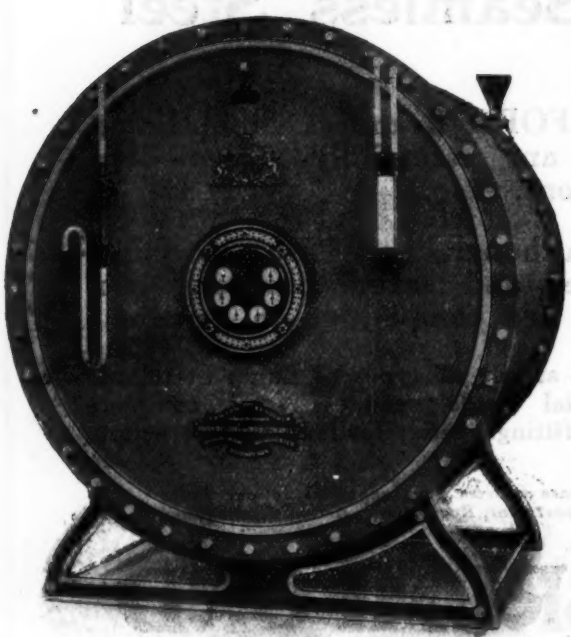

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